TECHNOLOGY DEPARTMENT

THE JOURNAL OF
THE INSTITUTION OF PRODUCTION ENGINEERS

VOL. XXVII - No. 1 - January, 1948

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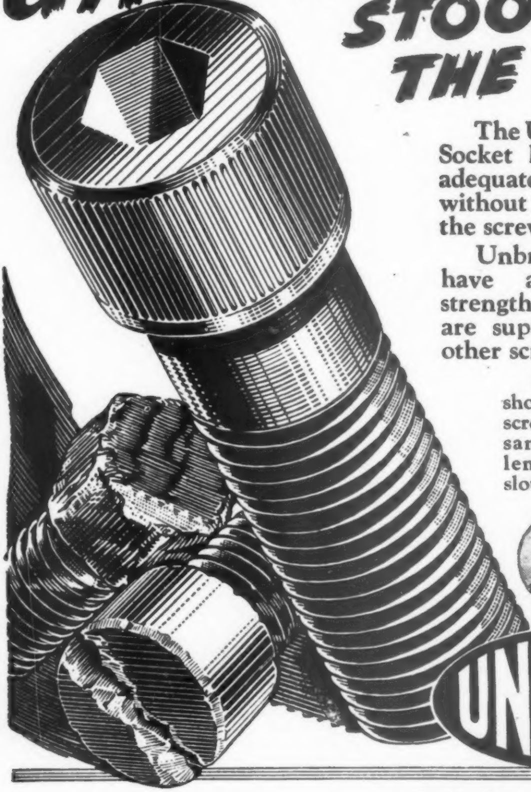

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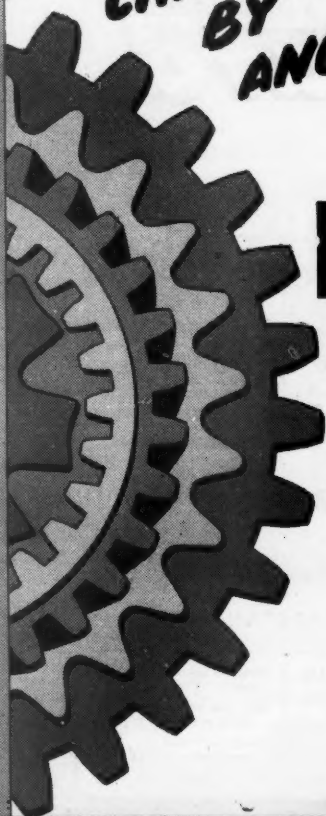

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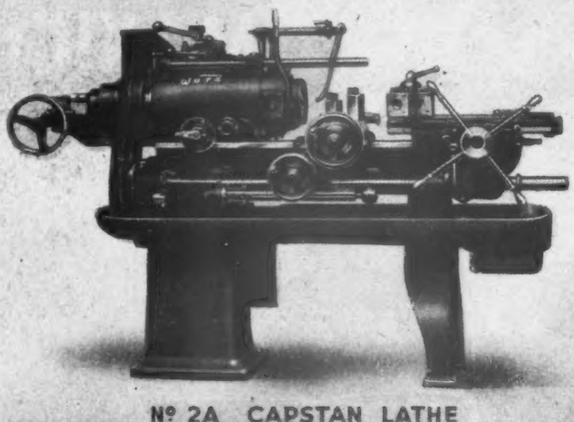

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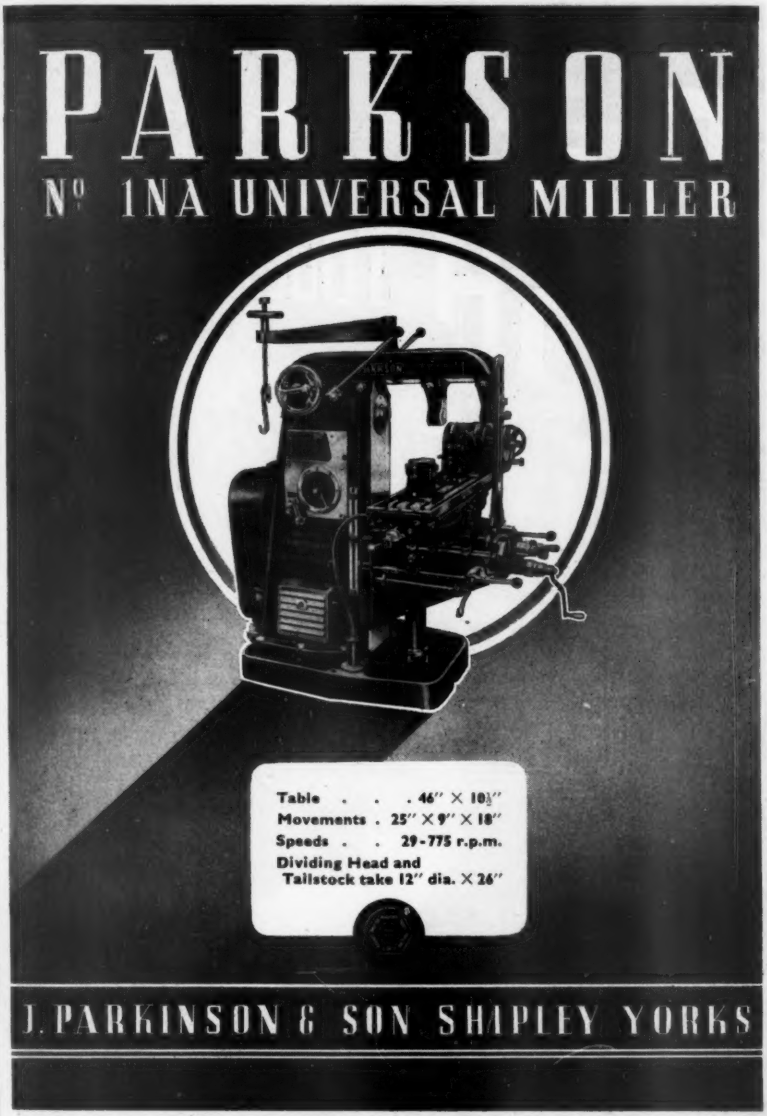
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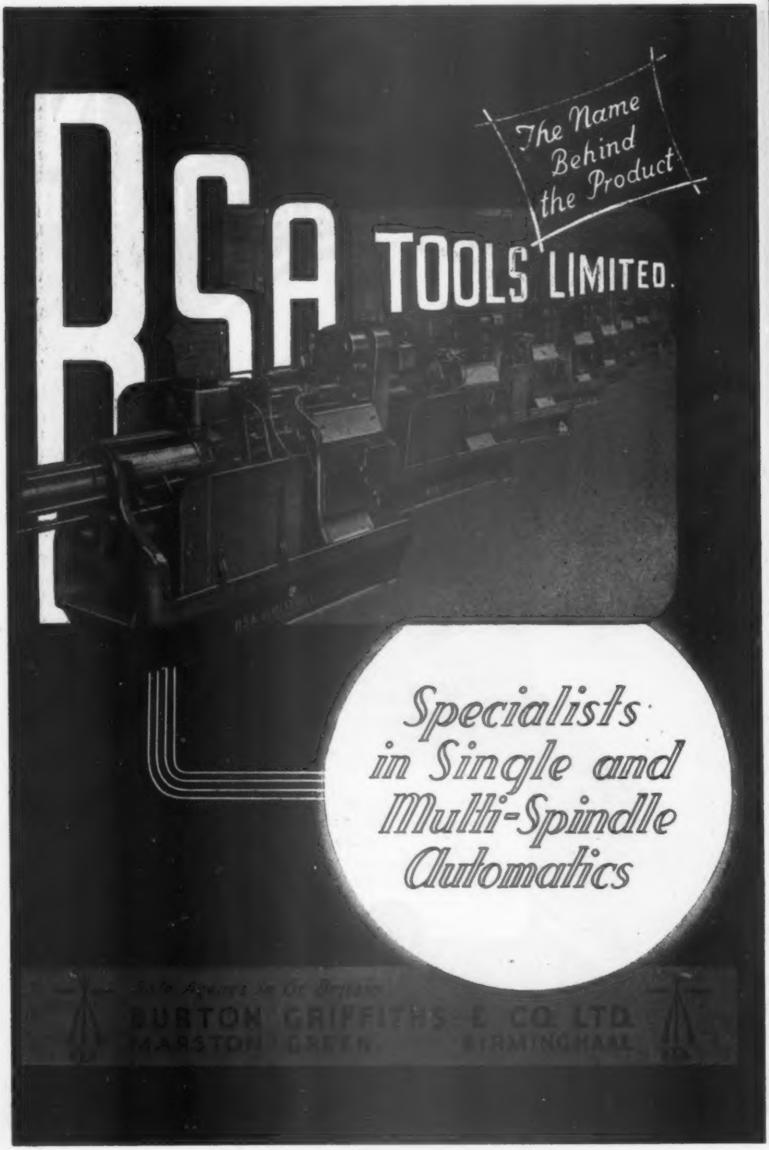
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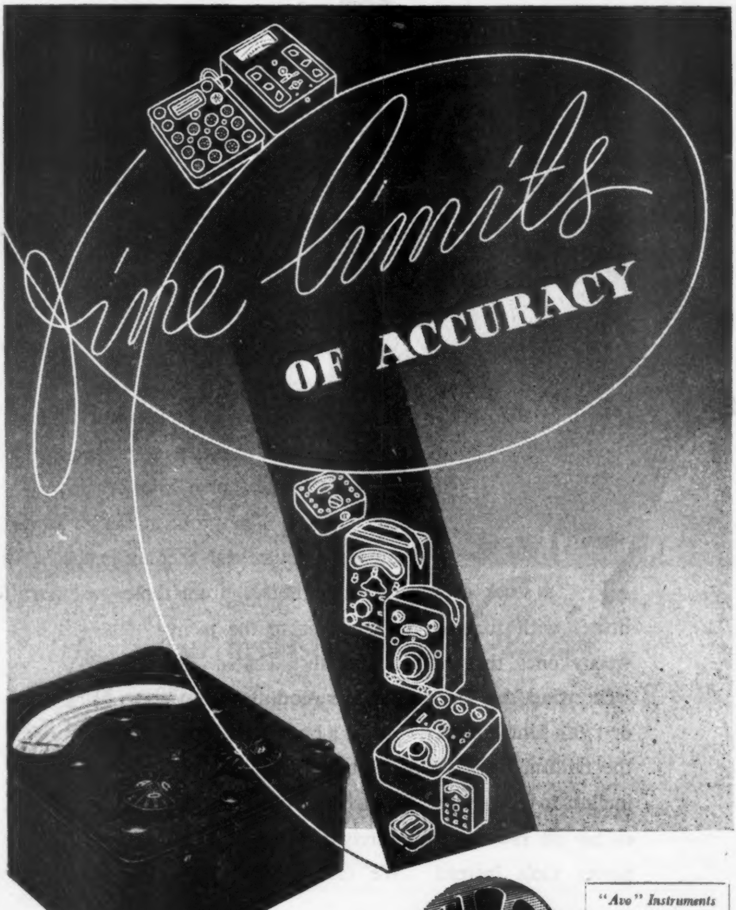

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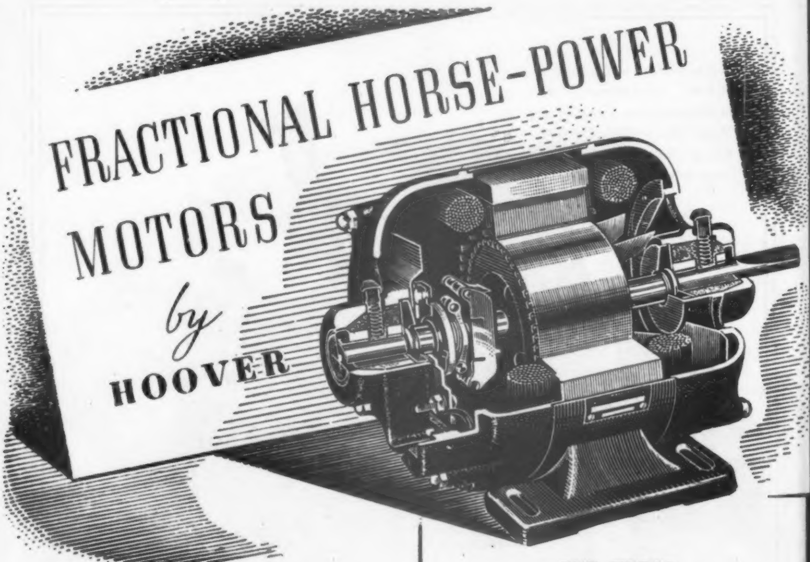

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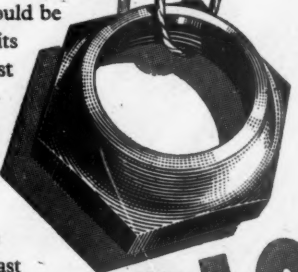

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INSTITUTION NOTES

January, 1948

COUNCIL MEETING The next meeting of Council will be held on 22nd January, 1948, at 11-00 a.m., at the Engineers' Club, Albert Square, Manchester.

THE ROORKEE UNIVERSITY (THOMASON COLLEGE OF ENGINEERING), INDIA It was announced in the October issue of the Journal that the President of the Institution, Mr. N. Rowbotham, C.B.E., had been invited to attend the Centenary Celebrations of the Thomason College of Engineering on 15th-16th December, 1947, and that the President would be represented on this occasion by Mr. J. D. Scaife, M.I.P.E.

We have now been informed that in view of the present difficulties and the considerable dislocation of traffic and distribution of food and materials in India at the present time, the Centenary Celebrations have been postponed until 15th-17th April, 1948.

NATIONAL FOUNDRY COLLEGE The National Foundry College, which is the successor to the British Foundry School is one of a group of National Colleges to be established by the Minister of Education on the recommendation of the recent Departmental Committee on Higher Technological Education, with which this Institution has been actively associated.

The College will be responsible for higher education in the technology of the industry which it serves, and will undertake all activities in the field of foundry education beyond those which can readily be undertaken by numerous local or regional colleges.

Mr. James Bamford, B.Sc., who was Head of the original British Foundry School, has been appointed Principal of the College, and took up his duties on 1st December, 1947.

The College will commence its first session on 5th January, 1948, the fee being £60 per student, payable in advance, for a 40 weeks' course. This fee may be reduced or remitted at the discretion of the Board of Governors in the case of students belonging to Associations or firms contributing financially to the College, of which the Institution of Production Engineers is one.

There is no age limit for students, who should, however, have had practical experience in at least one branch of the Industry. As far as technical qualifications are concerned, the standard required is that of the Higher National Certificate or a University Degree, preferably in Metallurgy or Engineering. A primary condition is that students should, by means of practical or technical training,

be in a position to take full advantage of the Course. A Diploma will be awarded to those successfully completing the Course. Due to the late start, the first session will be intensified and reduced to a period of 30 weeks.

Weekly visits to foundries and related plants will be arranged and students will be expected to write reports on these. It is also hoped at the end of each session to arrange a visit of approximately one week to a foundry centre. A considerable portion of time will be devoted to working out foundry projects in complete detail, from the blue print to the finished casting, including plant and equipment of foundries, and the remodelling of existing layouts, together with an assessment of the merits and different types of materials for castings. Moulding practices, melting metals and finishing processes connected with ferrous and non-ferrous castings will also be covered.

The College is located in the premises of the Wolverhampton and Staffordshire Technical College, and students will be given facilities for participating in the corporate activities of that College. It is anticipated that students will be nominated by their employers, who will undertake to release them for the period of the Course and provide maintenance.

Prospective students making independent application should enquire from their Local Education Authority concerning the possibilities of securing assistance towards maintenance, whilst qualified candidates released from the Forces should ascertain whether Government grants are available under education and training schemes.

The Board of Governors hopes to provide a hostel for those whose homes are not in the vicinity, but this will not be ready by the time the College is opened. Every assistance will, however, be given in finding accommodation for those requiring it.

Members will be pleased to note that Mr. J. W. Berry, M.I.P.E., has been nominated to represent the Institution on the Board of Governors of the new College.

All enquiries concerning the College should be addressed to: Mr. James Bamford, B.Sc., National Foundry College, Wulfruna Street, Wolverhampton, Staffs.

INDUSTRIAL CLOTHING COUPONS As a result of enquiries made at the Board of Trade, it has now been established that those individuals who are engaged in Time and Motion Study and Rate-fixing, and whose duties bring them in contact with machinery for more than 20 hours a week, are eligible for the award of the "Industrial Ten" clothing coupons.

BRITISH STANDARDS It has been decided to publish in future a list of newly issued British Standards and Draft B.S. Specifications which concern engineering processes and components of particular interest to members of the Institution, and which have been prepared by B.S.I. Committees on which the Institution is represented, together with the names of the I.P.E. representatives in recognition of their services.

The following Standards were issued during the latter part of 1947, and are obtainable from the British Standards Institution, 28, Victoria Street, London, S.W.1, at the price mentioned below :

Standards Issued		*Price*	*I.P.E. Representative on Appropriate B.S.I. Committee*
B.S.1313 : 1947	Fraction-defective Charts for Quality Control.	6/-	Mr. J. T. Kenworthy, M.I.P.E.
B.S.1397 : 1947	Safety Belts and Harness.	2/6	Mr. F. Southwell, M.I.P.E.
B.S.679 : 1947	Protective Filters for Welding and other Industrial operations.	2/-	Mr. F. Southwell, M.I.P.E.
B.S.309 : 1947	Whiteheart malleable iron castings.	2/-	Mr. F. Blackith, M.I.P.E.
B.S.310 : 1947	Blackheart malleable iron castings.	2/-	Mr. F. Blackith, M.I.P.E.

TWO MEMBERS GAIN LINCOLN AWARDS The Institution offers sincere congratulations to Mr. G. Keeble, Int.A.M.I.P.E., and Mr. E. F. Gill, M.I.P.E., both of whom were successful in the Third Award Programme sponsored by the James F. Lincoln Arc Welding Foundation, of Cleveland, Ohio, U.S.A. Papers were submitted from 17 industrial countries and awards were gained by 24 British entrants.

Mr. Keeble, who is Consulting and Research Engineer to Wall Paper Manufacturers, Ltd., Manchester, and a member of the Joint Research Council, submitted a paper describing in detail the welded fabrication of a 16-colour wallpaper machine, for which he was awarded £425.

Mr. Gill, who is a Chartered Mechanical Engineer, gained £25 and Honourable Mention for his paper on Arc Welding as applied to Design for Progress.

HALIFAX SECTION DINNER DANCE

The Mayor and Mayoress of Huddersfield, Councillor and Mrs. Oliver Smith, the President of the Institution, Mr. N. Rowbotham, C.B.E., the Right Hon. Lord Sempill, A.F.C., M.I.P.E., and the Director and General Secretary, Major C. B. Thorne, M.C., and Mrs. Thorne, were among the guests at the highly successful Dinner Dance organized by the Halifax Section and held at the George Hotel, Huddersfield, on Thursday, 20th November, 1947.

Proposing the toast, " The Institution of Production Engineers," Mr. Rowbotham expressed his pleasure at being present. It was an occasion on which he, as one who had been in engineering for some years, could pay tribute to the engineers of the great county of Yorkshire.

On all platforms, whether secular or Governmental, the drive for production was being increasingly urged. Mr. Rowbotham pointed out that the Institution of Producton Engineers was now widening its scope to cover all branches of the profession, whether heavy or light precision engineering. There was no county which had such a representative variety of engineering as Yorkshire, and although the Institution had a marvellous staff at Headquarters, its strength lay in the enthusiasm of its Sections and in Yorkshire, he knew, such enthusiasm ran high.

Lord Sempill, in reply, congratulated the President on the work being accomplished, and said he would like to pay tribute to him, on behalf of all Production Engineers, for showing them such a splendid example.

He went on to say that the world, and particularly Europe, was looking to Britain for a lead. Production Engineers were doing their job faithfully and well, so far as the material situation permitted. It was no good, however, ignoring the fact that a very serious situation was developing and one in which Britain must assume a leading position in world affairs.

Britain was expected to produce quality articles, and Lord Sempill suggested that all restrictive practices in connection with production and distribution should be made illegal. The power to manage with full authority must be restored to production management, and the vast and growing numbers of non-producers must be drastically curtailed. Transport, the life-blood of production, and representing some 70 per cent. of total cost, must be freed from restriction and allowed full operational activity.

There was a great deal of talk about the spirit of England weakening and people were talking a lot of nonsense about the view held by our friends in the United States.

Lord Sempill then quoted from a letter he had received from an American engineer, in which the writer commented : " I reserve a cynical smile for those who speak so glibly about the passing of the

British people from pre-eminence in the world scene. Their spinning wheels and mines may be outmoded, but they have character, and that is never outmoded."

Proposing the toast, " Our Guests," Mr. J. Milwain, President of the Halifax Section, said that the Section very much appreciated the fact that both Mr. Rowbotham and Lord Sempill, who were very busy people, had been able to attend this function. He also expressed the hope that national and local officials present would enjoy their visit, and paid tribute to the help they had given him.

The following Reports contain news of interesting Section activities :—

COVENTRY SECTION The Coventry Section arranged two visits to the works of the *Coventry Evening Telegraph* on 21st June and 28th June. A Joint Committee Meeting was held at the White Lion Hotel, Coventry, on 26th August to hear an address by Mr. F. Glover, M.I.P.E., of Melbourne, Australia. There was a full attendance by both the Senior and Graduate Members.

The Senior Section held a very successful Social Evening in honour of the New Section President, Mr. W. N. Ellerby, M.I.P.E., who was introduced by Mr. B. Newbold, M.I.P.E., Past President. The High Tea was held at the Geisha Cafe and afterwards all adjourned to the Coventry Hippodrome.

On Monday, 22nd September, Sir Reginald Rootes, Vice-Chairman of the Rootes Group, opened the Coventry Senior Section's Lecture Season with an address on " The Effect of the Change in the H.P. Tax upon Motor Car Production Engineering," at the Coventry Technical College. This was a highly successful evening.

The Coventry Section Committee sustained a severe loss in the death of Mr. H. A. Drane, M.I.P.E., who had been a great servant of the Institution.

Mr. H. D. S. Burgess, M.I.P.E., of this Section, has been on a visit to the U.S.A.

EASTERN COUNTIES SECTION Mr. T. S. Harker, A.M.I.P.E., a member of the Section Committee for many years, has resigned on his appointment as Principal of Wimbledon Technical College. Mr. C. Taylor-Cook, A.M.I.P.E., has been appointed Publicity Officer.

In addition to the usual six lectures to be held during the winter session, certain innovations have been made which, it is hoped, will prove helpful and interesting to members. On the night of the Annual General Meeting, two sound films are being shown, which will be of interest to members.

For Informal Discussions subjects of current interest will be

dealt with, one of which will probably be taken by a Graduate member. A Section Luncheon had been planned for October, but in view of present circumstances, this now unfortunately had to be cancelled.

LIVERPOOL SUB-SECTION The session opened on 26th September with the Inaugural Meeting and Dinner which attracted an attendance of 110, including 63 members, and was an outstanding success. The guests included the President, and the Director and General Secretary of the Institution, Presidents and Secretaries of neighbouring Sections, the Lord Mayor of Liverpool, the Dean of the Faculty of Engineering of the University, the Principal of the City Technical College, together with the Head of its Engineering Department, and the Regional Directors of every Government Department concerned with Production. The principal speaker was Dr. George Gibson, C.H., Chairman of the Regional Board for Industry, and his talk on the current National and International situation and its relation to Production was listened to with close attention.

A programme of seven lectures at the Liverpool University has been arranged for the winter session. One lecture is in conjunction with a Works visit. Membership of the Sub-Section totals 98 and there are six further applications before Council. The Sub-Section being now formally launched, and in view of the enthusiasm raised by the Inaugural Dinner, the Committee is confident of a rapid increase in Membership.

WESTERN SECTION The Committee of Western Section has met regularly throughout the summer, and arrangements have been completed for holding lecture meetings in Exeter, Gloucester, Chippenham and Swindon in addition to the usual five meetings to be held in Bristol. This policy of taking lectures to the "provinces" is a a new departure for the Western Section and the results are awaited with great interest.

At the start of the new session in July, 1947, the Committee co-opted Mr. A. O. R. Johnson, M.I.P.E., in order to bring the Committee up to full strength and have representation in the Stroud and Gloucester area.

It has unfortunately been considered advisable to cancel arrangements for the Annual Dinner and Dance in view of the National situation.

WOLVERHAMPTON SECTION No meeting was held during August, 1947. On 24th September a paper entitled " Future Development of Machine Tool Design " was presented, preceded by a film.

A joint meeting was held at the Star and Garter Hotel, Wolver-

hampton, on 24th November, with the Institute of Industrial Administration, the subject being " Production and Administration —What they mean to each other." The speakers were :

For I.I.A. : An administrator—Col. C. Cartwright, D.S.O., M.C.
An accountant—J. R. S. Underwood, Esq., A.M.I.I.A.

For I.P.E. : A manager—J. G. Legge, Esq., M.I.P.E.
A Production Engineer—A. B. Lloyd, Esq., M.I.P.E.

The Chairman was Mr. E. W. Hancock, M.B.E., M.I.P.E., F.I.I.A.

The Committee of the Wolverhampton Section has again offered a prize of two guineas to each of the following Technical Colleges for the best student of the year in Production Engineering : Wolverhampton, Dudley, Walsall, Wednesbury, Oakengates and Shrewsbury.

NEWS OF MEMBERS

Mr. J. S. Barker, Int.A.M.I.P.E., has taken a position as Production Manager with the Morgan Crucible Co., Ltd., London.

Mr. B. C. Barrick, A.M.I.P.E., has joined Associated Industrial Consultants, Ltd., as a Consulting Engineer.

Mr. H. Bowley, M.I.P.E., has been appointed Senior Principal Scientific Officer, Metrology Division, National Physical Laboratory, Teddington, Middlesex.

Mr. J. F. V. Brown, A.M.I.P.E., is now Service Manager to The Maudslay Motor Company, Coventry.

Mr. R. S. Brown, M.I.P.E., until recently Works Manager of the Production Department, Engine Division, Bristol Aeroplane Company, has taken up an appointment as General Manager of the Aircraft Division, and Mr. George W. Wright, M.I.P.E., has been appointed to the Works Manager's post vacated by Mr. Brown.

Mr. F. W. Clegg, A.M.I.P.E., has resigned his Directorship of the Exe Engineering Co., Ltd., and is now practising as a Consultant, specialising in the design, development and production of special purpose machinery.

Mr. C. Taylor-Cook, A.M.I.P.E., has been appointed Senior Lecturer in Engineering at the Royal Aircraft Establishment Technical College, Farnborough.

Mr. H. G. Cox, A.M.I.P.E., has become a Partner in the firm of Perox Engineering, Trowbridge.

Mr. G. A. Daniell, Int.A.M.I.P.E., is now Assistant Works Manager of Messrs. Steel Fabricators (Cardiff), Ltd.

Mr. J. A. T. Dickinson, M.I.P.E., has been appointed to the Board of Directors of B.S.A. Cycles, Ltd. He has been with the organisation for 33 years, and is General Works Manager of the Small Heath Works.

Mr. R. E. Dunnett, M.I.P.E., Director and Works Manager of Messrs. Crane Ltd., Nacton Works, Ipswich, has been appointed Assistant Managing Director. Mr. Dunnett was President of Eastern Counties Section during 1945-47.

Mr. H. Eckersley, A.M.I.Mech.E., M.I.P.E., hitherto Sales Manager, Wimet Division, Messrs. A. C. Wickman, Ltd., Coventry, is now General Manager.

Mr. J. S. Gordon, B.Sc., A.I.P.E., has returned to the United Kingdom from India.

Mr. A. Hamilton, Grad.I.P.E., has taken a position as Draughtsman in the Engineering Drawing Office of the Broken Hill Proprietary Co., Ltd., Whyalla, South Australia.

Mr. A. B. Hingley, M.I.P.E., has recently been appointed Managing Director of Messrs. Kears (Bristol), Ltd.

Mr. L. H. Jackson, Grad.I.P.E., is now working with Messrs. R. J. Spargo (Pty.) Ltd., New Doornfontein, Johannesburg.

Mr. H. T. Jones, A.M.I.P.E., is now Production Manager of Vatric, Ltd., Lanarkshire.

Mr. F. Koenigsberger, A.M.I.P.E., has taken up an appointment at the Manchester College of Technology as Lecturer in Mechanical Engineering.

Mr. W. J. Mason, M.I.P.E., is now Assistant Director of Ordnance Factories (P) in India.

Mr. J. A. W. Mills, M.B.E., M.I.P.E., has taken a position with Messrs. Dowty Equipment, Ashchurch, as Works Manager.

Mr. A. L. Nelson, Stud.I.P.E., is now Technical Engineer with Messrs. J. Shaw & Co., Ltd., Papermakers, Stainland.

Mr. S. A. J. Parson, A.M.I.Mech.E., A.M.I.P.E., has been appointed Senior Assistant in Production Engineering at Birmingham Central Technical College.

Mr. A. E. Ranger, Int.A.M.I.P.E., is now Assistant Works Manager of Fleetway Manufacturing Co., Edmonton.

Mr. A. Roberts, A.M.I.P.E., has joined the Cramic Engineering Co., Ltd., Southall, Middlesex, as Chief Planning Engineer.

Mr. D. R. Roper, Grad.I.P.E., is now Assistant Technical Officer with Imperial Chemical Industries, Ltd. (Alkali Division).

Major F. B. Schofield, R.E.M.E., A.M.I.P.E., has now been demobilised and has taken up an appointment on the Industrial Consulting Staff of Messrs. Stevenson, Jordan and Harrison, Ltd., Management Engineers, London.

Mr. J. T. Simmons, A.I.P.E., has taken up a position as Works Manager with Messrs. H. J. Elliott, Ltd., Pontypridd, Glamorgan.

Mr. A. C. Trubshaw, M.I.P.E., is now Works Manager of Messrs. Drummond Brothers, Ltd., Guildford.

Mr. S. Waugh, A.M.I.P.E., has been appointed General Manager of the Northern Bedding Co., Ltd., Newcastle-on-Tyne.

Mr. D. L. Wiggins, Int.A.M.I.P.E., has taken up the Directorship of Industrial Technics, Southampton.

Mr. P. E. Wilkins, M.I.P.E., is now Works and Production Manager to Messrs. Calum, Grant and Partners, Ltd., Tranent, East Lothian.

Mr. S. E. Willett, M.I.Mech.E., M.I.P.E., has been appointed General Manager of Clayton Dewandre Co., Ltd., Lincoln.

VISITOR FROM ABROAD

A recent interesting visitor to this country from the Sydney, New South Wales Section, was Mr. C. W. Done, A.M.I.P.E.

After spending 20 years with the Sunbeam Motor Car Co., Ltd., of Wolverhampton, Mr. Done went out to Australia in 1925 and established business as representative in Australia and New Zealand for Société Genevoise Limited, London and Geneva.

Mr. C. W. Done.

In 1941 he joined the Ministry of Munitions as Engineer for New South Wales and controlled the manufacture of Jigs, Tools and Gauges. In 1946 Mr. Done resigned to return as a Director of Mechanical Precision Equipment Co., representatives for Société Genevoise, Ltd. — his present position.

The object of Mr. Done's visit was to visit his principals in London and Geneva and to attend a world conference of representatives of Société Genevoise, Ltd., which was held at the Geneva Works from 8th-13th December, 1947.

OBITUARY

We deeply regret to announce the deaths of the following members, of which we have just learned : Mr. H. H. Flatman, A.I.P.E., of London Section ; Mr. J. Vairy,

Grad.I.P.E., of Halifax Section ; Mr. W. T. Vincent, Stud.I.P.E., of London Section ; and Mr. A. T. Price, Int.A.M.I.P.E., of Birmingham Section.

Mr. Flatman served his apprenticeship at the Royal Ordnance Factory, Woolwich Arsenal, and subsequently served in the Government Technical Service Departments. From 1924 to 1927 he was Progressman and Senior Draughtsman under the Chief Inspector of Armaments, and later became Estimator and Senior Equipment Assistant. During the war he was engaged as Inspector Grade II, and later Grade I, for the Chief Inspector of Armaments.

From 1926 to 1939 he gave part-time instruction in Engineering to various Technical Institutes under the London County Council.

When the Shrewsbury Sub-Section of the Institution was formed in 1944, Mr. Flatman became a Member of its Committee and served until he left the district in 1946.

ISSUE OF JOURNAL TO NEW MEMBERS Owing to the fact that output has to be adjusted to meet requirements, and in order to avoid carrying heavy stocks, it has been decided that the Journal will only be issued to new Members from the date they join the Institution.

IMPORTANT In order that the Journal may be despatched on time, it is essential that copy should reach the Head Office of the Institution not later than 40 days prior to the date of issue, which is the first of each month.

SECTION MEETINGS The following meetings have been arranged to take place in January and February, 1948. Where full details are not given, these have not been received at the time of going to press.

January

3rd WOLVERHAMPTON GRADUATE SECTION. A visit has been arranged to Messrs. Stewart & Lloyds, Bilston, starting from the Company's General Office at 9-30 a.m.

5th YORKSHIRE SECTION. A lecture on " Ball and Roller Bearings " will be given by Mr. F. Hickling, M.B.E., M.I.A.E., at the Hotel Metropole, Leeds, at 7-00 p.m.

7th PRESTON SECTION. A lecture on " Induction Heating " will be given at the Harris Institute, Corporation Street, Preston, at 7-15 p.m.

7th NOTTINGHAM SECTION. A lecture on " Heavy Engineering " will be given at the Victoria Station Hotel, Milton Street, Nottingham, at 7-00 p.m.

January—*cont.*

10th NORTH-EASTERN GRADUATE SECTION. A visit to Messrs. Churchill, Redman & Co., Ltd., has been arranged.

12th HALIFAX SECTION. A lecture on "Britain's Industrial Future" will be given by Mr. Lewis C. Ord at the White Swan Hotel, Halifax, at 7-00 p.m.

12th LUTON AND DISTRICT SECTION. A lecture on "Press Work" will be given by Mr. Grainger at the Town Hall, Luton, at 7-00 p.m.

12th DERBY SUB-SECTION. A lecture on "Making a Typewriter" will be given by Mr. R. N. Evans at the Art School, Green Lane, Derby, at 6-45 p.m.

13th BIRMINGHAM GRADUATE SECTION. A lecture on "Mechanical Handling in Factories" will be given by Mr. Hartford M. King at the James Watt Memorial Institute, Great Charles Street, Birmingham, at 7-15 p.m.

14th LONDON GRADUATE SECTION. A lecture on "Production Incentives" will be given by Mr. E. A. Gordon, B.Sc(Eng)., A.M.I.P.E., at the Assembly Room, Central Hall, Westminster, at 7-00 p.m.

14th LUTON AND DISTRICT GRADUATE SECTION. A lecture on "Efficient Tooling for Production" will be given by Mr. B. Holloway, A.M.I.P.E., in the Lounge, Midland Hotel, Luton, at 7-30 p.m.

15th GLASGOW SECTION. A lecture on "Cold Upsetting and Thread Rolling" will be given by Mr. T. C. Parker, M.I.P.E., at the Institution of Engineers and Shipbuilders in Scotland, 39, Elmbank Crescent, Glasgow, C.2, at 7-30 p.m.

15th MANCHESTER GRADUATE SECTION. A film on "Metal Spraying" will be introduced by Mr. W. E. Ballard, F.R.I.C., F.I.M., at the College of Technology, Sackville Street, Manchester, at 7-15 p.m.

15th LEICESTER SECTION. A lecture on "X-Rays in Industry" will be given by Dr. R. H. Herz, F.Inst.P., F.R.P.S., at the College of Technology, The Newarke, Leicester, at 7-00 p.m.

15th LONDON SECTION. A lecture on "Efficiency of Machining as a Basis of Production" will be given by Dr. G. Schlesinger at the Royal Empire Society, Northumberland Avenue, London, W.C.2, at 7-00 p.m.

January—*cont.*

16th EASTERN COUNTIES SECTION. A lecture on "Preventive Maintenance of Machine Tools" will be given by Mr. F. H. Ward, A.M.I.Mech.E., at the Lecture Hall, Electric House, Ipswich, at 7-45 p.m.

17th YORKSHIRE GRADUATE SECTION. A lecture on "Diesel Rail Traction" will be given by Mr. R. E. Ketley, M.I.Loco.E., at the Great Northern Hotel, Leeds, at 2-30 p.m.

21st WOLVERHAMPTON SECTION. A lecture on "Production of Fine Surface Finishes" will be given by Mr. H. W. Lawton, A.M.I.P.E., at the Wisemore Schools, Walsall, at 7-00 p.m.

21st BIRMINGHAM SECTION. A lecture on "Developments in Induction Heating" will be given by Mr. E. May, B.Sc., A.M.I.E.E., at the James Watt Memorial Institute, Great Charles Street, Birmingham, at 7-00 p.m.

21st WESTERN SECTION. A lecture on "Various Aspects of Inspection of Production" will be given by Mr. F. Nourse at the Grand Hotel, Bristol, at 7-15 p.m.

21st LIVERPOOL SUB-SECTION. A lecture on "Ball and Roller Bearing Production" will be given at the Arts Theatre, Liverpool University, at 7-15 p.m.

22nd HALIFAX GRADUATE SECTION. A lecture on "The Training of Apprentices" will be given by Mr. W. Pilkington, M.B.E., M.I.Mech.E., M.I.P.E., at the Technical College, Huddersfield, at 7-00 p.m.

28th MANCHESTER SECTION. A lecture on "Mechanical Mishaps and Their Relation to Design and Workmanship" will be given by Mr. C. E. Windeler, M.I.Mech.E., M.I.Mar.E., M.I.Consulting E., at the Mechanics Institute, Crewe, at 7-15 p.m.

29th GLASGOW SECTION. An Informal Discussion will take place at the Institution of Engineers and Shipbuilders in Scotland, 39, Elmbank Crescent, Glasgow, C.2, starting at 8-00 p.m.

February

2nd YORKSHIRE SECTION. A lecture on "The History and Development of the Automatic Loom" will be given by Mr. H. de G. Gaudin, B.A., A.M.I.Mech.E., at the Assembly Hall, Technical College, Keighley, at 7-00 p.m.

February—*cont.*

3rd COVENTRY GRADUATE SECTION. A lecture on "Industrial Administration" will be given at the Coventry Technical College at 7-15 p.m.

4th PRESTON SECTION. A lecture on "Factory Management—New Tools for the New Job" will be given by Mr. A. J. Charnock, M.I.P.E., at Messrs. Clayton, Goodfellow & Co., Ltd., Blackburn, at 7-15 p.m.

4th NOTTINGHAM SECTION. A lecture on "Light Engineering" will be given at the Victoria Station Hotel, Milton Street, Nottingham, at 7-00 p.m.

7th YORKSHIRE GRADUATE SECTION. A visit to Messrs. Jowett Cars, Ltd., Idle, near Bradford, has been arranged, starting at 2-30 p.m.

9th HALIFAX SECTION. A lecture on "Cutting Lubricants and Coolants" will be given by Mr. H. H. Beeny at Whiteley's Cafe, Westgate, Huddersfield, at 7-00 p.m.

9th LUTON AND DISTRICT SECTION. A lecture on "Management" will be given by Lt.-Col. C. W. Mustill, M.B.E., M.I.P.E., A.M.I.Mech.E., at the Town Hall, Luton, at 7-00 p.m.

10th BIRMINGHAM GRADUATE SECTION. A lecture on "Bearings Production" will be given by Mr. W. H. Lilly at the James Watt Memorial Institute, Great Charles Street, Birmingham, at 7-15 p.m.

11th SOUTHERN SECTION. A lecture on "Die Casting", accompanied by a colour film, will be given at University College, Southampton, at 7-30 p.m.

11th SHEFFIELD SECTION. A lecture on "Wire Drawing and Wire Drawing Machinery" will be given by Mr. H. Richards at the Royal Victoria Hotel, Sheffield, at 6-30 p.m.

11th WESTERN SECTION. A lecture on "Jig and Tool Design" will be given by Mr. R. O. Jeakings at the College, Swindon, at 7-30 p.m.

12th LONDON SECTION. A lecture on "Inspection—Small Batch Inspection and Large Scale Production Inspection" will be given by Mr. P. S. Crooke, M.I.P.E., and Mr. A. G. Powell, A.M.I.E.E., at the Royal Empire Society, Northumberland Avenue, London, W.C.2, at 7-00 p.m.

13th COVENTRY SECTION. A lecture on "Tungsten Carbide Milling" will be given by Mr. W. W. Taylor in Room A5, Coventry Technical College.

February—*cont.*

14th MANCHESTER GRADUATE SECTION. A lecture on "Hydraulics" will be given by Mr. H. C. Town, M.I.P.E., at the College of Technology, Sackville Street, Manchester, at 7-15 p.m.

16th DERBY SUB-SECTION. A lecture on "The Structure of Management" will be given by Mr. G. Chelioti at the Art School, Green Lane, Derby, at 6-45 p.m.

18th WOLVERHAMPTON SECTION. A lecture on "Plant Maintenance" will be given by Mr. D. Bailey, A.M.I.P.E., at the Wolverhampton and Staffordshire Technical College, Wolverhampton, at 7-00 p.m.

18th BIRMINGHAM SECTION. A lecture on "Some Measurements of British and American Industrial Efficiency" will be given by Mr. Lewis C. Ord at the James Watt Memorial Institute, Great Charles Street, Birmingham, at 7-00 p.m.

18th WESTERN SECTION. A lecture on "Manufacture of Ball and Roller Bearings" will be given by Mr. R. L. Tardy, A.M.I.P.E., at the Grand Hotel, Bristol, at 7-15 p.m.

18th LIVERPOOL SUB-SECTION. A lecture on "Production Welding in the Workshop" will be given by Mr. A. E. Griffin, M.Inst.W., at the Arts Theatre, Liverpool University, Liverpool, at 7-15 p.m.

18th LUTON AND DISTRICT SECTION. A lecture on "Production Control" will be given by Mr. A. H. Huckle, F.I.F.M., M.I.Econ.E., A.M.I.I.A., in the Upstairs Lounge, Midland Hotel, Luton, at 7-30 p.m.

19th GLASGOW SECTION. A lecture on "Drop Forging" will be given by Mr. J. Douglas Latta at the Institution of Engineers and Shipbuilders in Scotland, 39, Elmbank Crescent, Glasgow, C.2, at 7-30 p.m.

19th LEICESTER SECTION. A lecture on "Malleable Castings —Applications in Engineering and Machine Shop Practice" will be given by Mr. W. E. Marshall at the College of Technology, The Newarke, Leicester, at 7-00 p.m.

20th EASTERN COUNTIES SECTION. A lecture on "Cold Upsetting and Thread Rolling" will be given by Mr. T. C. Parker, M.I.P.E., in the Lecture Hall, Electric House, Ipswich, at 7-45 p.m.

21st BIRMINGHAM SECTION. The Annual Dinner Dance will be held at the Botanical Gardens, Edgbaston.

February—*cont.*

25th MANCHESTER SECTION. A lecture on "Rolling Bearing Application" will be given by Mr. R. K. Allan, M.I.P.E., at the College of Technology, Sackville Street, Manchester, at 7-15 p.m.

25th HALIFAX GRADUATE SECTION. A lecture on "Steel Wire Production" will be given by Mr. Peter Smith, M.W.M.A., M.Inst.B.E., at the Technical College, Halifax, at 7-00 p.m.

27th NORTH-EASTERN GRADUATE SECTION. A lecture on "Some Improvements in Production Methods" will be given by Mr. G. Pool, Grad.I.P.E., in the Lecture Theatre, Neville Hall, Newcastle-on-Tyne, at 6-45 p.m.

27th YORKSHIRE GRADUATE SECTION. A lecture on "Principles and Practice of Metallurgical Testing and Research" will be given by Mr. J. W. Poole, Grad.I.P.E., A.M.I.B.F., at Keighley, at 7-00 p.m.

ELECTION OF MEMBERS

MEETING OF COUNCIL, October 30th, 1947.

The following were elected to membership by Council :—

As MEMBERS :

W. E. Bullock, C. H. Cunniffe, M.B.E., J. S. Elliott, C. E. A. Griffin, O.B.E., R. Hall, J. H. Hartley, E. J. W. Herbert, F. H. J. Mills, S. Poxon, A. M. Razzell, T. F. Ring, P. Smith, S. F. Steward, C.B.E., H. G. Sutton, L. Sutton.

As ASSOCIATE MEMBERS :

W. F. Atkins, E. Ayland, A. W. Barnett, J. N. Bose, L. A. Boone, F. J. Bradbury, T. S. Bromfield, V. N. Butler, D. L. Campbell, M. M. R. Choudhury, E. D. H. Christie, J. Cocker, C. L. Cook, W. D. Dorward, E. C. Driver, W. Edwards, R. Ellis, L. P. Evans, A. Gleed, A. Glendenning, W. F. Gough, E. D. Greenwood, W. A. Hawkins, J. Hayton, A. Hector, G. R. Hill, J. T. Hillier, A. G. Hinz, G. C. Hooson, I. G. Hopkinson, A. Houlton, J. Hunt, H. Instone, C. R. Johnson, W. Lawrie, H. M. Lawson, H. J. J. Malcolm, R. W. Mason, A. F. Muir, D. E. Murray, E. F. P. Ockenden, J. A. Page, J. L. Price, P. J. Quincey, A. Robinson, F. Robinson, M. Rodger, E. Shackleton, F. Shaw, J. O. Sheppard, A. G. Slater, W. L. Soul, R. Teasdale, J. H. Turner, N. M. Walton, W. T. Webster, E. Williams, W. Wilson, J. Wright.

As INTERMEDIATE ASSOCIATE MEMBERS :

A. D. Banks, S. C. Bate, S. L. Bedi, J. E. Belton, J. E. Booth, T. J. Brennan, L. G. Brown, J. L. Burbidge, F. W. Burton, A. E. Capper, W. F. Cover, T. Dickson, M. J. Dixon, J. F. W. Galyer, N. N. Gandhi, R. K. Gejji, G. R. Gemes, L. T. Giles, D. L. Grist, D. V. Gough, M. W. Hall, W. G. Haggitt, A. Heaton, N. Hesford, C. C. Hodson, J. C. B. Hood, A. Jones, B. G. Johnson, K. D. Kohli, H. O. Luck, A. G. R. Mackie, C. W. W. Maddern, V. V. Mahabale, G. R. Markham, J. Merkine, J. K. L. Murray, J. W. Naylor, A. F. Noutch, Y. S. Oke, T. Owen, R. W. Pile, J. W. Powell, H. B. Preston, A. Rowden, W. H. Shrieves, C. Singh, K. L. Smith, H. C. Taylor, C. C. Trapp, L. G. Trim, C. G. Walker, J. H. A. Webb, W. J. C. Wells, G. W. Whitworth, A. Williams, J. W. Wills, A. Wilson, J. C. M. Woolhouse.

As ASSOCIATES :

J. A. Burras, J. R. Finnimore, G. B. Leather, H. G. Rust.

As GRADUATES :

K. R. Addison, R. St. John Aylieff, A. R. Banbury, N. Barnett, P. J. Berry, W. Buchan, H. S. Butcher, H. L. Cull, R. Davies, D. H. Digby, G. E. Duffin, J. D. Duggan, W. Edelstein, A. R. Fletcher, A. Flett, C. A. Greatbatch, J. L. H. Girling, W. Hancock, C. H. Harris, J. C. Hawkins, P. J. Hawkins, R. A. Hunter, A. R. Jeffs, R. P. Menon, I. W. Monroe, S. K. Niyogi, R. L. Noakes, A. Parker, R. T. Ridgway, R. S. Ritchie, D. F. H. Rushton, G. Schreiber, G. P. Shepherd, W. Steiner, H. R. Sumner, L. Walker, S. W. Whittington, J. R. Woodhall, T. Woodall.

AS STUDENTS :

G. C. Arthur, L. Bainbridge, G. Baron, A. O. Bray, J. F. Bedford, W. J. Botting, W. K. Burley, R. Carter, R. G. Clark, V. W. G. Curtis, R. T. Croft, R. C. Duffield, E. M. Fail, H. L. Faull, W. E. Gosling, C. J. Guest, J. W. Harwood, R. L. Holford, S. Howe, T. P. James, G. E. Kroschel, A. B. Lowe, L. Lyall, P. J. Maishman, A. E. Mason, E. J. Ockerby, D. Oldroyd, J. Ottenborgsen, R. Roberts, A. L. Rutherford, S. W. Swingle, J. E. Townsend, J. T. Wallace, S. D. Warmington, D. A. L. West, J. L. Whiteley, K. W. Wiltshire.

AFFILIATED FIRMS :

E. G. Acheson, Ltd.	T. D. Ough.	Change
C.V.A. Jigs, Moulds & Tools, Ltd. ...	W. J. Baverstock.	Change
Northern Aluminium Co., Ltd. ...	J. H. Mayes.	Additional

COUNCIL ALSO APPROVED THE FOLLOWING TRANSFERS:

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FROM ASSOCIATE TO ASSOCIATE MEMBER :

T. L. Morton.

FROM GRADUATE TO ASSOCIATE MEMBER :

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FROM GRADUATE TO INTERMEDIATE ASSOCIATE MEMBER :

A. Johnson, H. G. Whittaker.

FROM STUDENT TO GRADUATE :

N. Asquith, J. W. Burton, J. B. Clayton, H. J. Faull, R. W. Fort, J. A. Goucher, J. A. Gough, A. G. Henry, J. E. Johnson, N. Marsh, C. G. Middleton, A. L. Nelson, J. Pearson, J. J. Peck, A. A. Ryall, J. Senior, A. W. Stannard, G. L. Tredwell, F. Varo, S. H. Walters, D. Wooldridge.

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WELDING VERSUS CASTING AND RIVETED STRUCTURES

by J. G. NOBLE, A.M.I.Mech.E., A.M.I.Struct.E.

Presented to the Halifax Section of the Institution of Production Engineers, November 25th, 1946.

So many papers on welding have been given in this district that it is with some diffidence that I stand here before you to-night. The title I was given to lecture on implies a general talk on the fundamental aspects of welded fabrication ; but welding is not only a specialised subject, it is a small host of specialities in itself—my own particular interest lies in the direction of efficient design for welded parts and structures, since most of the advantages and economies of welding can be exploited or lost at this stage. As I see it, it is very necessary for the Production Engineer to take an active interest in this stage, so that proper use may be made of the workshop processes available.

It is difficult to give information which is entirely new in a paper of this description, since the fundamental peculiarities (I won't say that they are always advantages) of welding are the same all the time—but let us see just what there is about welded steel construction that can be turned to advantage.

(*a*) Parts can be joined together without the need of connecting members.

(*b*) The joints, when made, are absolutely rigid, are permanent, and cannot shake loose.

(*c*) There is, generally speaking, more freedom in design to place metal where it will do most good, and certain restrictions of foundry and riveting shop practice do not stand in the way. These are the main points which will be considered to-night. I propose to concentrate on the one welding process of manual metallic arc welding, but we must not forget that there are many other welding processes—automatic metallic or carbon arc, oxy-acetylene, atomic hydrogen, and the resistance welding group of spot, seam and flash butt welding. The metallic arc process is the one most widely used, though, just as in any other healthy production process, there is continuous development all the time.

Flame-cutting is, of course, a close ally of the welding processes, and it enables intricate or simple shapes in steel to be cut readily, later to be fabricated into one piece.

I do not propose to dwell on the actual operations of welding and flame cutting too much, since the main principles of each process must be well known by now.

WELDING VERSUS CASTING

We all know of the present difficult labour situation in iron foundries—it is sufficient for me to say that this has stimulated interest so much in welding that people are now prepared to pay more for welded parts than for the equivalent casting, but I would like to show that this is not always necessary—an exact copy of a casting shape, which was designed to suit the casting process, is nearly always uneconomical, whereas some careful thought and design of a welded part *for welding* often results in a lower cost than the casting, though some change in appearance may be necessary. The first fundamental is that there should be as little flame cutting or welding in a design as possible—they are not expensive processes, but every cubic foot of gas has to be paid for, and every electrode used on a job costs money to buy and deposit, and may bring undesirable distortion of the welded part. On the other hand, straight edges of plate can be sheared cheaply, and a folded corner of flange can be made in a fraction of the time of a welded one. Rolled steel sections are available in many shapes, and the use of these in a design will often save the cost of many feet of welding. Attention to these points when changing over a part from cast to welded construction can sometimes save as much as 30 per cent. of the casting cost, with a better appearance and surface for painting, rigid, unbreakable and entirely reliable. One must not overlook the other advantages of steel—greater tensile strength, with a stiffness of 2½ times cast iron. We haven't yet finished with this subject, however. Though there are many advantages in changing over a part at a time for welded construction, by far the largest savings are made by designing a whole machine for welding. Dimensional changes here and there allow a far greater use of shapes and sections, reducing even more the cost of plate preparation. Sometimes, what was once two castings may be combined into one welded part, of a shape that was unsuitable for casting, thus saving many hours of machining and fitting. It is obvious that this principle is capable of application to any type of machine in cutting out machining and fitting time that serves no useful function in the completed machine. The reservations are just as obvious—it must be possible on the welded assembly to machine other faces which are necessary for the functioning of the machine.

This brings me to another point—it is not always necessary to machine faces or holes *after welding*. There are many minor parts of machines which can be machined first before welding, using a smaller and quicker machine tool for the purpose, e.g., drain plug

bosses for gear cases can be machined on a bar lathe in quantity, or even a standard fitting like a gas locknut can be used. For other welded parts, such as levers, bosses can be bored and key-wayed before welding. In jig and fixture work there are usually two groups of elements, the locating and holding parts. These latter can often be pre-machined at great saving in cost, with much reduced delay in tooling up—there is material here for a separate paper in itself—I will let it pass now by saying that there should be an arc welding machine in every toolroom.

Coming back to general fabrication, there is much scope for pre-machining—even an important face can be machined before welding and taken as datum for subsequent machining on other parts of the fabrication.

WELDING VERSUS RIVETED WORK

As I said in my introductory remarks, one advantage of welding is that no connecting members are necessary, and this is most apparent in structural welding. Gusset plates disappear, and punched holes are almost entirely unnecessary. The latter means that there is no weakening effect of holes in tension members, and a corresponding reduction in section can be made over a riveted design. This brings no economies for compression members, where the factor l/r is usually the limiting factor; but here it is often possible to employ tubular members, which are most efficient as struts—these are not readily riveted since there is no access to the inside, but this question does not arise in welding.

Welding has been employed in structural work in many ways, and three distinct steps are traceable.

(a) Simplification of detail work in column bases, caps and the like.

(b) Simple welded trusses and framed members, using lap joints without gussets, welding instead of riveting.

(c) Plate girder work, of the heavier type, which lends itself ideally for fabrication.

(d) As in replacing castings, it has now been found that it is best to design shapes particularly for welding, taking advantage of the fully rigid joints that can be made, and this is typified by the portal frame type of construction for single storey buildings and workshops. A two-pinned frame such as this is redundant, and the design calculations are accordingly much more intricate, but the resulting structure has a better appearance and employs the steelwork to better advantage. In riveted design, it has been usual to consider connections as being pin jointed, though they are often far from it; this has resulted in slender columns and heavy beams. Recent research has shown the desirability of taking into account the partial

fixity of riveted connections which transmit bending stress from the beam to the columns, and this *must* be taken into account when welded joints are employed.

As far as the economics of welded structures are concerned, site welding is still an expensive item, and in many types of structure such as steel-framed multi-storey buildings, some erection bolts are still desirable to give location to the various members. Generally speaking, as much as possible of the welding should be done in the shops, where handling facilities are better—use can be made of manipulators to enable most of the welds to be made in the down-hand position. It is dangerous to generalise of course ; I know a large contract where the amount of welded work has justified the installation of simple workshops on site, all material being delivered direct from the mills cut to length.

In industrial plant work, such as bunkers, hoppers, storage tanks, gasholders ,etc., welding has many advantages to offer, particularly for containers. The joints when made are permanently leakproof, no maintenance being required on them. Painting and weather protection is simpler, due to the absence of rivet heads. In this class of work, the conventional angle stiffener as used for riveting has almost entirely disappeared ; and its place taken by a flat welded-on edge to the plate. Where an angle *is* used, it is placed more effectively with the metal as far as possible from the neutral axis.

CONCLUSION

I have tried to give some general idea of the advantages of welding over riveted work and castings, together with some indications of the main factors controlling cost. It is well to experiment cautiously in welding certain classes of work, particularly parts which are dynamically loaded. A very slight undercut at the edge of a weld can be a very definite stress raiser ; inspection of finished welds should be careful. Due to the rigid nature of the joints, careful attention must be given to stress flow and the welds so placed that they have the least effect on this, e.g., Liberty ships—hatches and deckhouses ; plate girder butts, plate girder tee stiffeners. Research is still going on with regard to structures, and various reports have been issued for guidance in design.

But apart from these cases of severe dynamic loading, there are many thousands of cases where loads are relatively uncomplex, and welding is quite capable of carrying heavy loads. In addition, there are many general engineering parts which carry almost no stress at all—altogether, discounting future research on the difficult problems and relying on present day knowledge, there is still a very big field for welded construction which has hardly been touched.

COLD FORGINGS

by C. J. WHITCOMBE

Presented to the London Section of the Institution of Production Engineers, February 13th, 1947.

It is the intention of this paper to show up the possibilities and limitations of the process known as Cold-forging. The art of forging has been known for many centuries. (This should not be confused with forgery which has also been known for a long time !) In early days the majority of forging was carried out hot by the blacksmith, though there is no doubt that the advantages of cold work on metals was appreciated. Beaten copper and hammered iron were used for all kinds of purposes and are typical examples of cold working metal. Gold leaf is another excellent example of how metal was worked cold. The stamping of coins is yet another example.

These early metal workers were, really, more artists than anything else and there was little science in their methods. To-day cold forging has grown to a science. It is not intended to deal with coining or cold rolling and similar processes but to consider the production from wire of parts in which a large amount of forging is done.

Cold forging is carried out for two main reasons :—

(1) To save material and increase production.

(2) To increase strength by cold working and the resultant change in structure.

DEFINITION OF COLD FORGING

Forging may be defined as changing the shape of a piece of metal by heating and hammering and cold forging is the same process undergone without first heating the metal which is to be forged.

It must be realised that with hot forging the material becomes plastic and so there is practically no limit to the change in shape which can be made. There is, however, a very severe limitation to what can be done cold without inter-annealing. This limitation is directly proportional to the physical properties of the material being worked and in particular to the reduction in area or elongation.

The illustration (Fig. 1) shows a number of cold forgings which have been selected with the object of showing up the variety of parts which can be cold forged. It will be seen that most of these have been produced from round wire, but two examples have been included to make it clear that square, rectangular or other form of stock may also be used. Similarly, the forged portion may be round or of other shape as desired within the limits of the process.

PRINCIPLES OF COLD FORGING The fundamental principles of cold forging are governed by the law that a slug of metal when subjected to pressure will deform so that the metal flows in the direction of least resistance.

If a piece of cold forging quality wire, say $\frac{3}{8}$ in. dia. by 1 in. long, is cut off and stood on end on a hardened steel block and then struck squarely on top with a heavy hammer, the piece will be upset as the result of the blow and will bulge considerably at the centre (Fig. 2A). If a second similar piece of wire is taken and placed into a $\frac{3}{8}$ in. dia. hole in a hardened steel block in such a manner that half of it protrudes, a blow will upset the piece so that it assumes the shape shown (Fig. 2B). The projecting section will bulge as before but the portion remaining in the block must necessarily retain its shape as it is confined in all directions. Repeating this second experiment, but using a hammer containing a hemispherical recess of appreciably the same volume as the protruding portion of wire, this portion will assume a hemispherical shape, due to its confinement within the recess (Fig. 2C).

In the same way a recess in the block or partly in the block and partly in the hammer will also restrain the flow of the wire.

This brings us to our first limitation. The proportion of the upset end must be such that the bulging takes place symmetrically. If an attempt is made to upset too great a length, the projecting wire collapses in the same manner as a strut and does not flow evenly (Fig. 2D). The malleability of the material being forged imposes a further limitation. Should an attempt be made to overwork the material a general breakdown of the structure takes place.

The block is commonly referred to as the die and the hammer as the punch.

COLD HEADING OF COMMON PRODUCTS The earliest cold forgings made from wire were probably nails and wood screws, the first automatic forging machine being developed some 120 years ago. In cases such as these wire from a coil was fed through a die and a head formed by a single blow from a punch. Basically, the same principle applies to-day.

Let us consider the simple case of a wood screw blank. Wire is fed through a cut-off die between the main heading dies which are split in two halves and which are slightly open to reduce friction. The lower half of the die is raised, thereby shearing a pin length and at the same time closing the dies, hard against a stop. In this position a punch strikes the wire protruding from the dies and upsets it to the form of the recess in the die (Fig. 3A). This recess is sometimes in the punch and sometimes partly in the die and partly in the punch depending on whether the screw is to

have a Countersunk, Round or Raised Head (Fig. 3B). The dies are then opened and the feeding through of the next length ejects the headed blank.

Nails are produced in very much the same way. These are the simplest types of cold forging.

SPLIT AND SOLID DIE COLD FORGING If a solid die instead of a split die is used, the pin length of wire must be cut off first and then pushed into the die by the punch. As soon as this pin length meets the ejector at the back of the die, the length still projecting will start to upset. When completely upset the punch withdraws and the headed blank is forced out of the die by the ejector (Fig. 3C).

These two methods which have first been described are known as split die heading or forging and solid die heading or forging, respectively.

The former method suffers from the disadvantage that small fins are formed under the head due to the metal being forced between the split in the dies whereas the latter method suffers from the disadvantage that long lengths cannot be forged due to the friction between the blank and the die. With long lengths the blank tends to upset or buckle before it is fully home, and, what is even more important, after upsetting the metal is so firmly wedged in the die that it is almost impossible to eject the blank.

The illustration (Fig. 4) shows a typical battery of solid die heading machines.

COLD FORGED BOLTS Probably the most noteworthy cold forged article to-day is the common bolt. In this case the size of the head is such that one blow would buckle the protruding wire and so the forging is carried out by two blows, the first merely bulging the wire a short distance from the end by confining this end during the blow, the second blow forms a cylindrical cheese head. The hexagon is subsequently shaped by forcing the head of the bolt through a die thereby shearing off the unwanted portion of the head. This operation is usually carried out on an independent machine designed for the purpose. The thread of the bolt is afterwards cut or more often rolled. When the thread is rolled the diameter increases, so the rolling diameter has therefore to be made less than the shank diameter. This is done on the heading machine by what is known as the process of extrusion. When the pin length is forced into the die by the first blow punch it is forced past a constriction in the die which reduces the diameter. This process may be compared to wire drawing in which case the wire is pulled through the die instead of pushed. Fig. 5 shows the various stages in the manufacture of a cold forged bolt. Fig. 6 shows a typical heading machine of the type on which bolts are forged.

There are machines which make a bolt outright, performing all the operations just described, these machines being known as Boltmakers and Fig. 7 shows clearly the operations carried out.

GRAIN FLOW

At this point it is time to say something about what is happening inside the metal when it is forged.

Let us consider the case of steel which is the commonest cold forging material. Wire is produced from rod which is produced from billets which in turn are produced from blooms which are rolled from a cast ingot. The solid ingot has a uniform crystalline structure and the effect of rolling it down to rods is to cause the grains to elongate in the direction in which rolling takes place. Up to the rod stage all the work on the steel is done hot. The conversion from rod to wire is however carried out by drawing the rod through dies, cold. The cold work thus done on the steel compresses the metallic grains. The result of all this is that there is a distinct line of flow of the granular structure. By making a longitudinal section of a piece of wire, polishing and etching it, this grain flow, as it is called, becomes apparent. On such wire the longitudinal strength is greater than the transverse strength. This means that it is harder to shear at right angles to the grain flow than parallel with it. This is a very important point and accounts for the great superiority of cold forgings.

When the wire is upset and headed the grain flow changes direction according to the manner in which it is upset. The illustration (Fig. 8) shows the grain flow in a headed bolt.

This is an exceptionally good forging and the grain flow is symmetrical and very even. Such perfection is hard to maintain in production, a slight concertina effect being more usual.

In all these cases it will be seen that the strength of the head of a cold forged bolt is greatly increased since any tendency for it to sheer off is at right angles to the grain flow, unlike the head of a bolt which has been machined from a hexagon bar.

Fig. 8 also shows what happens at the point of extrusion and the effect of thread rolling is just discernible.

METALLURGICAL EFFECT OF COLD FORGING

Closely connected with the grain flow and the inside of the bolt is the metallurgical structure.

Let us consider a cold forging steel containing ·32/·37 Carbon ·70/·79 Manganese. The drawn wire will have a tensile strength before cold forging of about 36/42 tons tensile. The structure of the wire before forging will be similar to that shown in Fig. 9 at 150 × Mag. It consists of ferrite and pearlite and directionality due to hot rolling and more particularly cold drawing is apparent. The grain boundaries are, however, clearly defined.

Fig. 10 at the same Mag. shows the result of cold forging. This

is at a heavily worked point in a bolt head. The ferrite and pearlite grains have been crushed together so that directionality is even more evident. The grain boundaries are completely eliminated and laminar pearlite would not resolve itself, even at high magnifications.

If a heavily forged steel, such as this, is stress relieved, the structure will return to something like its original form, but the grain size will have been greatly reduced which in itself is a refinement. Certain classes of bolt are stress relieved without subsequent heat treatment but the highest quality of cold forged bolts are, however, fully heat treated.

The fault in steel wire which gives the cold forger one of his biggest headaches is "pipe". Quite obviously this causes the metal to split when forged : this is fortunate as it does show up the fault unlike a similar fault in a bolt turned from the bar.

COLD FORGING OF NUTS

Until comparatively recent years there were only three main classes of nut, the highest quality being turned from the bar, the next being hot forged and third being stamped or pressed nuts.

Now, the introduction of cold forged nuts has largely superseded bar and hot forged nuts for use with the smaller and more common diameters of bolt.

This nut is an exceedingly interesting example of the art of cold forging—such nuts are made from round wire and forged to a hexagon shape on what is known as a transfer heading machine. The illustration Fig. 7 shows the various stages in the complete cycle of operations.

EXAMPLES OF COLD FORGING

The principles of cold forging have now been dealt with and the most common cold forged articles namely, nails, screws, bolts and nuts, etc., referred to. It is now necessary to consider the scope of cold forging and the many diverse objects which can be produced by this method. This should make it clear that cold forging is not limited to simple headed parts, but also to a wide variety of specialised, though in many cases everyday, pieces.

Fig. 1B shows a Wing Bolt with a square shoulder under the head. With such a large head as this, annealing has to be carried out between some of the forging operations. It is remarkable how much material goes to form the head. In the example shown there is nearly twice as much material in the head and the square shoulder as there is in the shank.

Incidentally nib bolts can be very successfully cold forged as is seen by Fig. 1A.

Swaging is commonly used in conjunction with cold forging and a socket cap screw can be made by heading, drilling a circular

recess and swaging on to a hexagon mandrel thereby forming a hexagon recess. Obviously turning operations have to be carried out on articles of this kind due to the uneven flow of the metal caused by the hexagonal shape of the recess. Subsequent machining operations on cold forgings are not uncommon, though efforts are always being made to eliminate them.

Fig. 11 shows how forging is not confined to the ends of wire but can also be carried out intermediate of the ends. Four common articles are shown here, namely, the end of a kick start crank on a motor-cycle, the pump holder of a bicycle, spring rollers of a car and a screw driver shank.

Fig. 12 is a part of the Borg & Beck clutch and shows very well what can be done in intermediate forging. Once again the advantages of cold forging can be seen by the grain flow. (Fig. 12A)

Fig. 13 shows some interesting examples of cold forgings. The scissors are an exceptional example and so also are the two handles at the bottom left-hand corner. These are used for such things as fish slices, tin openers, etc. It should be noted, however, in this case how riveting portions are thrown up in the forging operation.

CONCLUSION It is hoped that this short talk will have shown something of what can be done by controlling the flow of metal under one or a series of blows.

Naturally the final success or otherwise of cold forging depends on economics or the improved quality of the finished article.

NOTE: On illustrations, Figs. 1, 7, 11 and 13 a halfpenny is shown to give an indication of size.

DISCUSSION Mr. Parker said it was a little embarrassing for him, as a competitor of the author's firm, to open the debate but he was sure that Mr. Whitcombe would take in the right spirit any remarks he made.

He thought the author had made a mistake in saying that the occurrence of non-metallic impurities in the centre of the wire was the greatest bug-bear of the cold forger and suggested that the greatest bug-bear was, in fact, the presence of surface defects on the outside of the wire.

Bolts had improved so much in quality since they had been made by the cold forging process, and their physical properties had improved so tremendously, that Mr. Parker did not understand why it was still necessary to have wood screws which had to be put into a hole with a comparatively loose fit and consequently worked loose or, alternatively, had to be put into a fairly tight hole, with the result that they broke off at the thread or half the head was lost. Could the author explain why it was that high tensile and high physical property wood screws were not produced?

Mr. Whitcombe agreed that surface defects on the wire were a source of great trouble to the cold forger. Mr. Parker would probably agree with him that surface defects were troublesome because although they did not have a very great effect on the strength of the bolt, they looked so bad that when there was a slight surface defect the users of bolts were very worried about them. That was probably why surface defects were a great bug-bear to the cold forger.

He did not agree that there was any necessity for a higher tensile wood screw to be made. Those that were made at present were in the region of 40 tons tensile, and he thought they stood up to the majority of uses. There was no reason why a higher tensile wood screw should not be made, but there was no call for it. It should be realised that a bolt nearly always held together metallic parts which had a substantial strength, whereas a wood screw held together wooden parts which compared with the screw had not such a substantial strength.

Mr. Parker, referring to the author's statement that the average bolt that one would expect to receive had not a uniform grain flow around the head, but had a concertina effect, said he believed that the process of cold forging had originally been discredited owing to incorrect grain flow, and he would suggest that the concertina effect was neither necessary nor desirable. In lectures that he had given he had emphasised the fact that he was very much in favour of concentrating on the avoidance of the concertina effect which definitely weakened the head. The author would probably agree with him on that point. He did not think that the grain flow was normally quite so bad as that in the illustration which the author had shown.

With regard to the bolt maker, the machine which produced the whole product from the wire, Mr. Parker suggested—and he would like the author's opinion on this point—that that type of machine, which embodied a number of operations in one machine, was not as good for high quality work as the individual machine. He thought production engineers realised that the single-operation machine was more easily controlled for accuracy. A machine of the type in which a number of quite tricky operations were combined took a considerable time to set up, and when a setter had taken a long time to get a machine running in all its operations, if there was one little point that was not 100 per cent. right he tended to let it go uncorrected, whereas he would correct it if the machine was a single-operation one.

Mr. Whitcombe said he would take the two points raised by Mr. Parker together, because the question of the grain flow was very much tied up with the bolt maker. He thought Mr. Parker would agree with him that on a two-blow heading machine there

was a definite tendency to get a rather wavy effect, which he agreed was very much exaggerated on the slide that he had shown. He did not think that a slight concertina effect was particularly undesirable. In his opinion, it did not weaken the head to any great extent, unless it was lopsided or was very much exaggerated. In the latter case it definitely weakened the head.

With regard to the bolt maker, the extrusion which took place before the first upset helped to give a far more even grain flow in the head, and although such machines as bolt makers were very tricky and annoying to run and maintain in condition, when they were running properly they produced very good bolts. He was inclined to agree with Mr. Parker that small batches of very high quality bolts were best made on machines which carried out the various operations individually, as they could be controlled much more easily than a very complicated machine. Where large quantities were required, a bolt maker or a machine of that type, a transfer head, was preferable.

Mr. Parker said that he disagreed with the author, and would be prepared to prove that on the average the grain flow produced when a two-blow header was used was very much more uniform than that produced by the bolt maker. He did not think that point need be argued any further, but he would point out that in the case of the bolt with a magnificent grain flow which the author had shown in one of the slides, the hexagon was eccentric to the shank. Perhaps the author would look at the slide afterwards and not show it again as depicting a very fine bolt.

Mr. Kerr said that much of what he had intended to say had already been said by Mr. Parker, but he would like to mention that the author's very fine film did not show one stage of the inspection which he would like to have seen, namely, an actual crack detection in a bolt. During the war crack detection in the case of aircraft bolts had been carried out very thoroughly indeed, as he thought Mr. Parker would agree. That brought him back to what Mr. Parker had said about surface defects. Those having been eliminated, he thought the necessity to crack-detect was also eliminated.

The President asked how the percentage of reduction due to extrusion, which he thought was done in two stages, compared with a single stage of wire drawing, and how it was ensured that the shank above the point of extrusion did not swell so as to affect the shank diameter that was required.

Mr. Whitcombe replied that the angle of the constriction prevented the shank swelling too much. Unless that angle was just right, extrusion was exceedingly difficult. The amount of extrusion depended on the form of thread being rolled afterwards. With wire drawing one could reduce to any desired amount within

the limits of the physical properties of the material concerned. With extrusion it had to be a definite amount which was based on the type and diameter of the thread which was to be rolled. The rolling diameter was most important, and if a good thread was to be obtained, that diameter had to be held to very close limits.

The President said he appreciated that, but he wanted to know whether it was possible to reduce as much by extrusion as one could in a single stage of drawing.

Mr. Whitcombe said that was so, but it must be remembered that the bolt shank had already been wire drawn to some extent, and it was not always fully annealed after drawing. It was usually in a semi-hard condition.

Mr. Edler, referring to the question of lubrication, said he imagined that there must be a great deal of what might be called metal to metal contact—contact between the wire or pin and the dies, and a tendency to seize up, and the author had probably experimented a good deal with different types of lubricant, perhaps including colloidal graphite. He would be glad if the author could give the meeting some information on that subject.

The method which the author had shown of making the socket-head screw had rather surprised him and, he believed, one or two other people also. He had thought that it was made the other way round, i.e., that a hexagonal mandrel was pushed into the head already formed in a previous operation. He would like to know why the method shown by the author had been adopted. Was it easier from the point of view of mechanical operation, or did it involve a metallurgical consideration ?

With regard to the inspection shown in the film, he thought it was a rather antiquated method, as it showed a girl holding a gauge in one hand and holding a bolt against it in the other. He would like to know whether the film was intended for the public as well as for production engineers.

Mr. Whitcombe said the question of lubrication was very important. Various oils were used, and on the larger sizes of bolt, lubrication was obtained by oiling the wire before it was fed through into the cut-off die. A great deal of vapour would have been noticed in the film, and that was caused by the oil vaporising due to the heat which was generated in forging. A tremendous amount of heat was generated in cold forging, in spite of its name. Normal lubricating oils were used, such as were used in other types of engineering work of a similar kind. Soluble oils could also be used.

There were definitely two other methods of manufacturing socket screws. One of them was to force the cap or the drilled portion of the cap on to a hexagonal mandrel and then force it through a hole

of rather smaller diameter than the cap. That was something like extrusion, and it was done in the United States to a considerable extent. The other method was to broach the hexagon socket.

The film shown had been prepared mainly for semi-technical or lay audiences. It had not yet been shown generally and the present showing of it had been in the nature of a preview, so any criticisms or comments were of great interest to him. The method of using the Wickman gauge which was shown was not so antiquated as Mr. Edler thought ; it was a percentage check that was taken, and very much better idea of quality could be obtained with a hand check of the type shown. As Mr. Parker had said, it appeared that the bolt was being forced through the gauge, but the girl doing the inspection was so nervous that the shot had to be taken about six times before it was as good as the one finally used.

Mr. Davis said he had been particularly interested in the automatic machines shown by the author, which seemed to be the very last word in such machines, but he had not been very impressed with the hand operations. There appeared to be very little motion study or bringing of the work into a convenient position for the operator. His criticism of the film would be that many of the slow motion shots were not slow motion shots at all, and it was rather difficult to see the actual operation of the machine, particularly in the rolling operations. Also, he wished the film could be shown without the musical background and with someone explaining the operations in greater detail.

Mr. Whitcombe replied that the film had not been prepared for showing primarily to technicians. The reason he had shown it that evening was that it contained some very good shots of cold forging, which showed the work being done considerably more slowly than natural speed. As far as the musical background was concerned, this had been fitted, since the film was designed for general purposes and not for purely technical purposes.

Mr. Donnelly, referring to the question of inspection, said there was a difference of statement between the lecture and the film. It had been said that 100 per cent. inspection was carried out, but surely modern statistical methods were much more effective than 100 per cent. inspection. One hundred per cent. inspection of the large quantities of products made in a modern screw factory did not give anything like the efficiency that could be obtained by modern statistical methods.

Mr. Whitcombe thought Mr. Donnelly was under a slight misapprehension. The 100 per cent. inspection to which reference was made in the film was a visual inspection ; it was not carried out on every single measurement, but the general visual inspection was 100 per cent., to make sure that no faulty bolts were overlooked. In the case of wood screws, the inspection was 100 per cent., but

again it was visual, to remove faulty or damaged screws. He agreed that statistical methods, such as quality control, were exceedingly important for actual measurement.

Mr. Davies said that the most efficient method of inspection was 100 per cent. The object of quality control was not to make the inspection more efficient, but to save labour in inspection.

Mr. Donnelly agreed, but said that when one came to inspect vast quantities of small parts, it was the other way round. In the inspection of large numbers of small parts, it was inefficient to attempt to inspect 100 per cent.

Mr. Redman asked what was the average percentage of tensile strength that could be obtained in cold forging by the methods which the author had described.

Mr. Whitcombe said he was not sure that he quite understood the question. The increase in strength due to cold forging was, of course, in the head, and the increase in tensile strength of the bolt was obtained afterwards by heat-treatment.

Mr. Redman said that Mr. Parker had referred to screws breaking, and he himself had experienced that. He thought it was a fault with all screws, but there must be a certain amount of excessive cold working which took place and which increased the hardness of the screw generally and caused it to fail in this manner. What percentage of increased hardness did the author generally obtain, or what percentage did he allow to pass?

Mr. Whitcombe thought that failure—assuming the screw was used correctly—was due to such things as slots being too deep and threads being cut too deeply at the point of breakage, and that was to a large extent due to excessive production under exceedingly difficult conditions and shortage of labour. It was not possible to give any figure for the actual increase in hardness, because it occurred on the head and depended on the amount of forging that took place. The hardness in the shank was obtained during the wire drawing process prior to forging.

Mr. Alexander asked whether there was any advantage in rolling a thread with a cylindrical die as opposed to a flat die.

Mr. Whitcombe replied that the great advantage of using a circular die as compared with the use of a flat die was that the screw could be rolled over a far greater length of die ; in other words, the circular die could be rotated a number of times, and that was equivalent to using a flat die of extreme length. With a cylindrical die the length or the distance over which the screw was rolled could be increased with ease, and one could thereby roll higher tensile materials and get a very much better finish on the surface of the thread.

Mr. Parker said there was one question which had not been

asked but the answer to which he thought would interest many people, namely, what class of steel was used for the tools that were employed in the cold forging machines.

Mr. Whitcombe replied that the normal steel used for the dies of a screw heading machine, for example, was 1 per cent. carbon steel. Tungsten carbide dies had also been tried, but they were very much more difficult to use, owing to the shock which was given to the die under the blow.

Mr. White said that his firm used chiefly 1 per cent. carbon steel for split dies, which was very simple to handle, but they had done a good deal of work with tungsten carbide and had achieved very considerable success with it in the case of certain components. The use of tungsten carbide saved a good deal of setting time. On some of their machines his firm were using better quality steels on an experimental basis, but the 1 per cent. carbon steel gave excellent results.

Mr. Whitcombe said he had heard of high-grade cast iron being used for dies.

Mr. Calpin said that when cold heading was done with small solid dies with, say, a bore diameter of 1/10 or less, there was difficulty in hardening, owing to the area inside the hole being so large that steam was generated in the heat-treatment and water cooling was excluded.

Mr. White said it depended on the method used for quenching, and the way in which it was applied. His firm had numerous contrivances for applying water and they also had methods of closing up and venting, which overcame most of the troubles. They produced a vast quantity of the dies and experienced no difficulty. On solid die forging machines they used a considerable amount of high speed steel, but that was not applied so much to wood screw products. It was very effective on certain ranges of articles and was used quite considerably.

Mr. Laurens, in proposing a vote of thanks to the author, said that Mr. Whitcombe had read a most interesting and instructive paper and had shown a magnificently produced film, both of which had evoked a considerable amount of discussion. Papers were judged by the quality of the discussion, and in that respect he was sure that Mr. Whitcombe must have been satisfied.

The motion was carried with acclamation and the meeting then terminated.

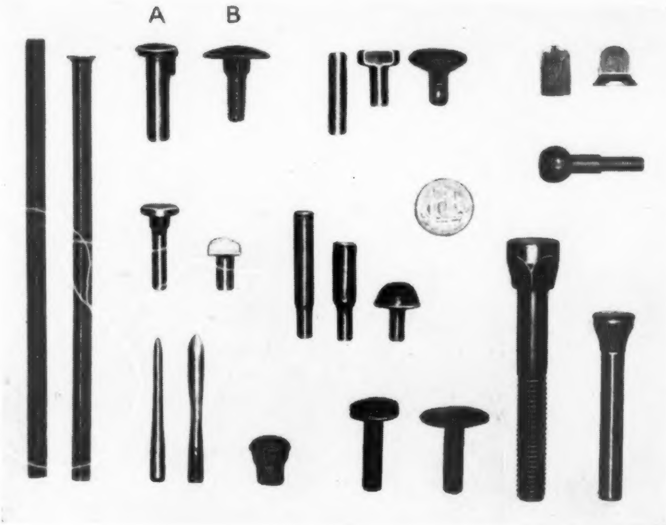


FIG. 1.

FIG. 4.

Fig. 5.

Fig. 6.

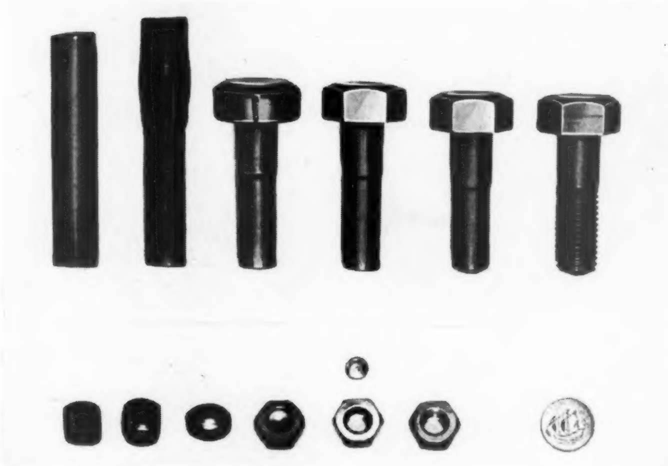


FIG 7.

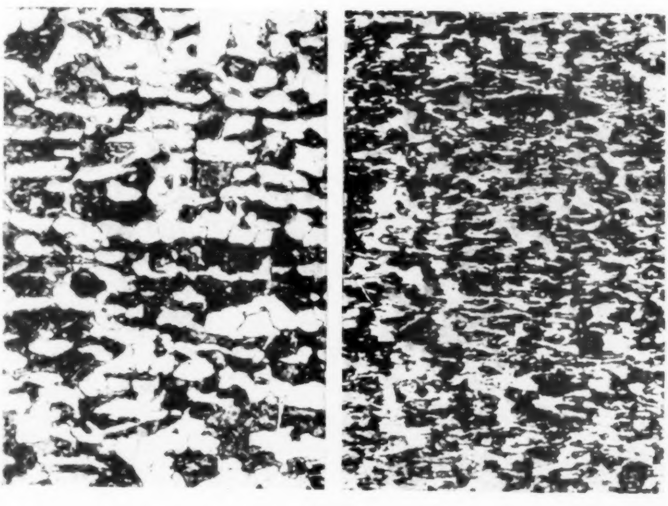


FIG. 9.

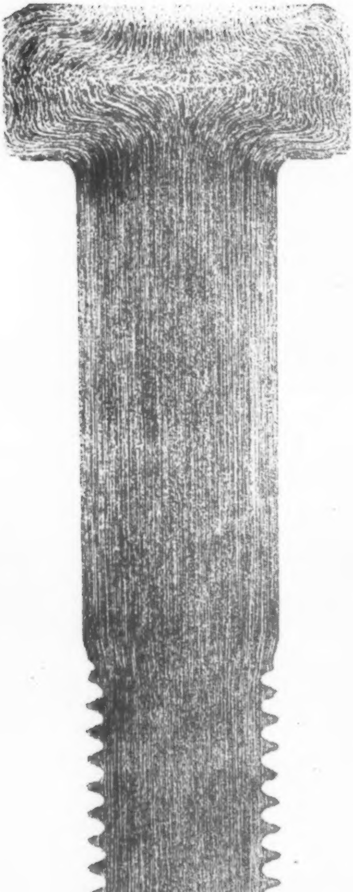
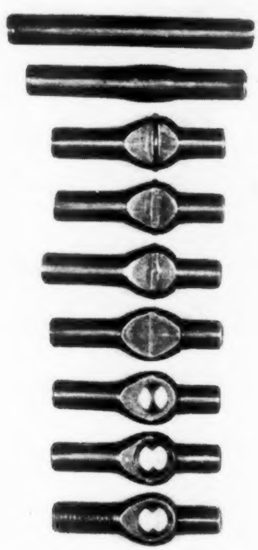


FIG. 8.

Above—
FIG. 11.



Left—
FIG. 12.

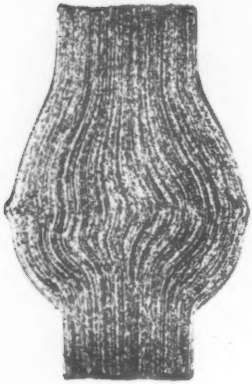


FIG. 12A.

FIG. 13.

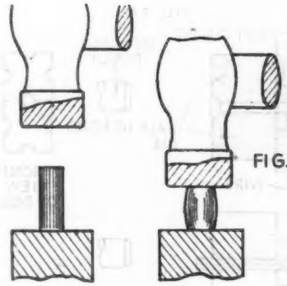


FIG.2A

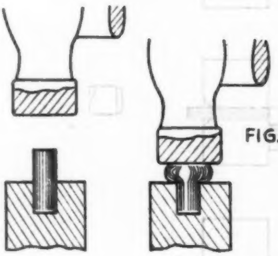


FIG.2B

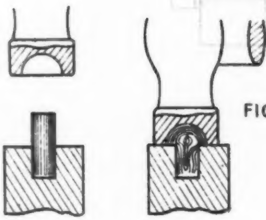
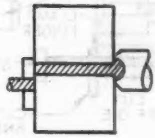


FIG.2C

FIG.3B



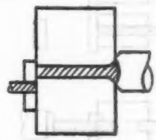
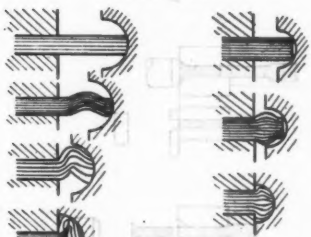


FIG. 2D



GOOD

BAD

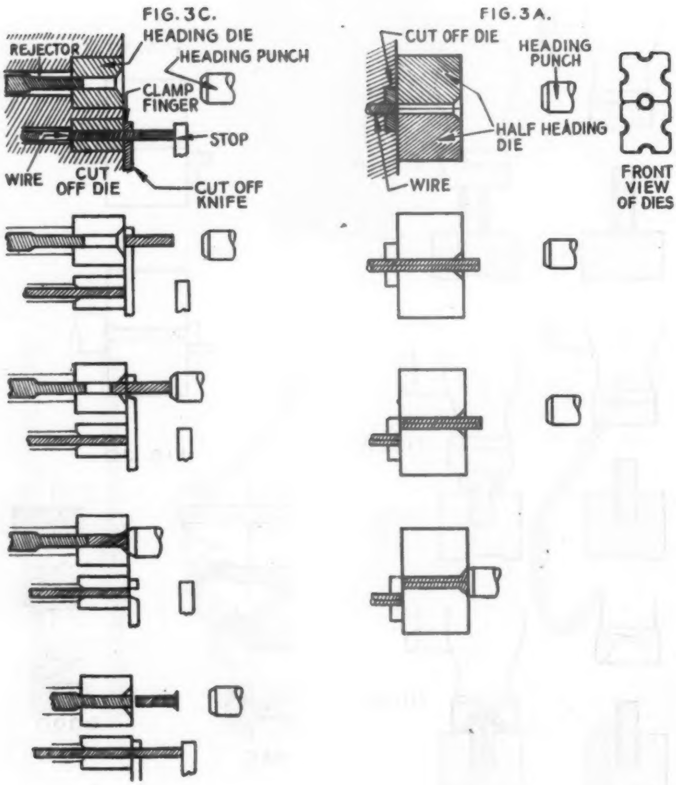
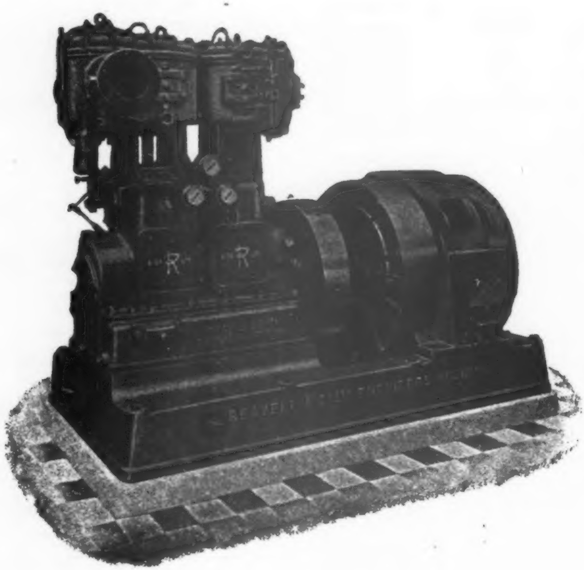


FIG. 3C.
HEADING DIE
REJECTOR
HEADING PUNCH
CLAMP FINGER
STOP
WIRE
CUT OFF DIE
CUT OFF KNIFE
FIG. 3A.
CUT OFF DIE
HEADING PUNCH
HALF HEADING DIE
WIRE
FRONT VIEW OF DIES

AIR COMPRESSORS



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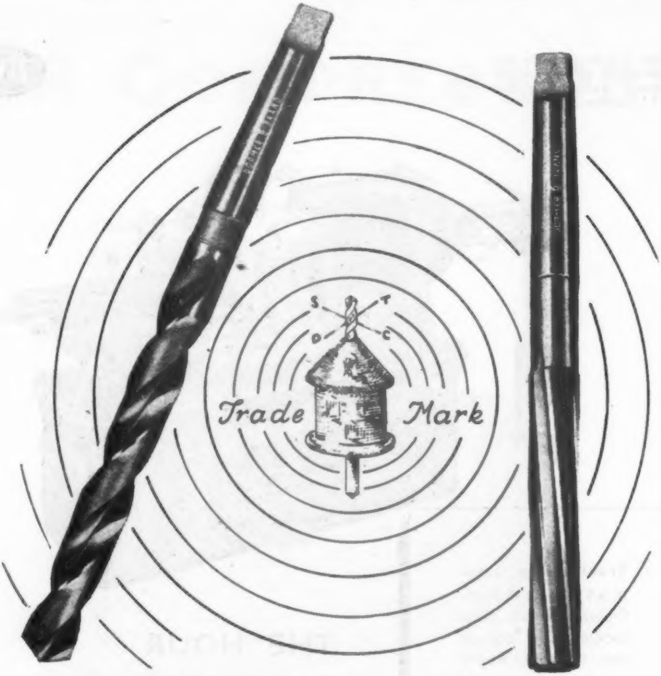

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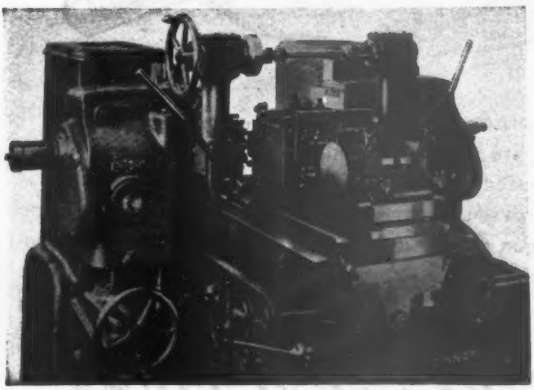

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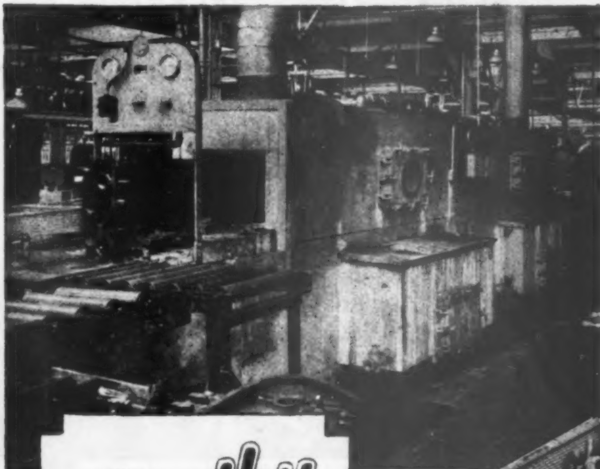

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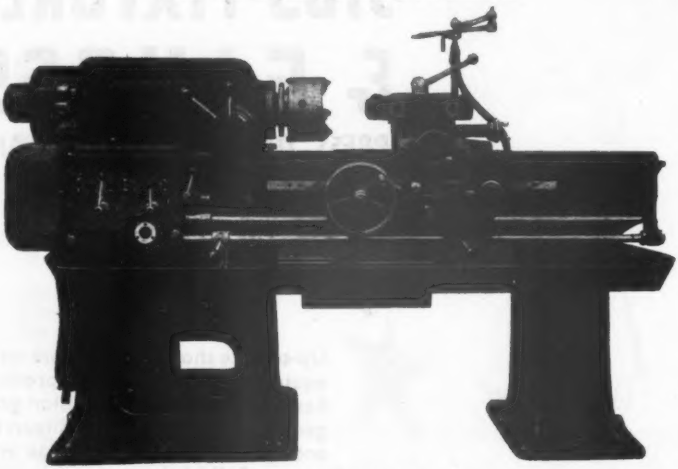

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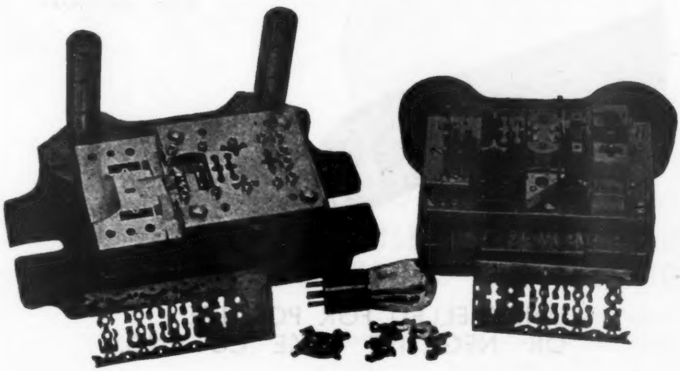

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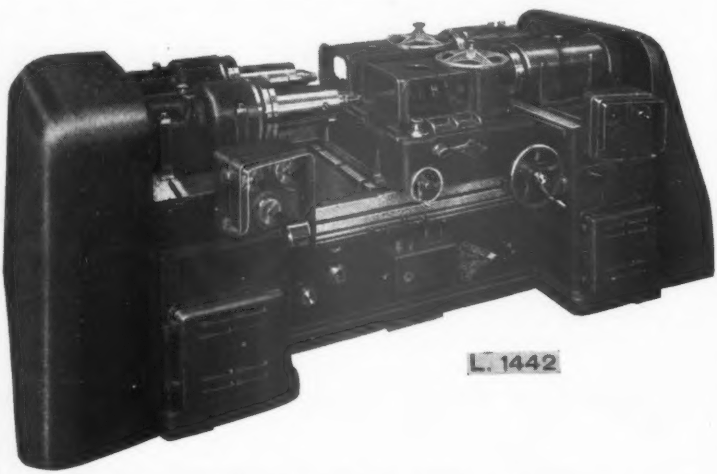

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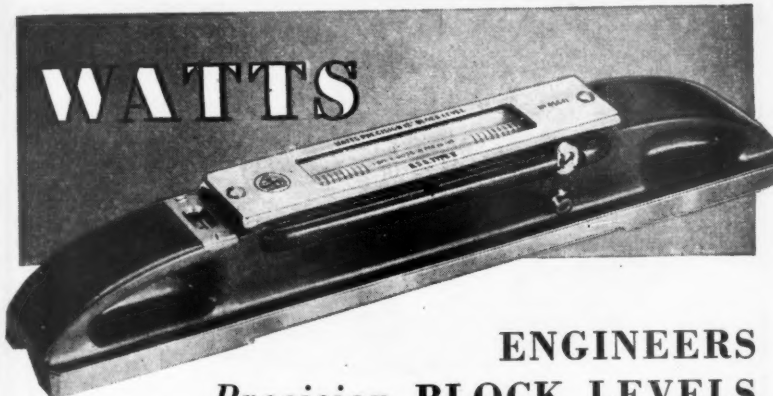

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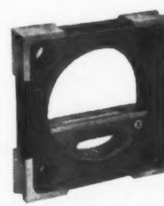

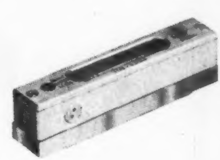

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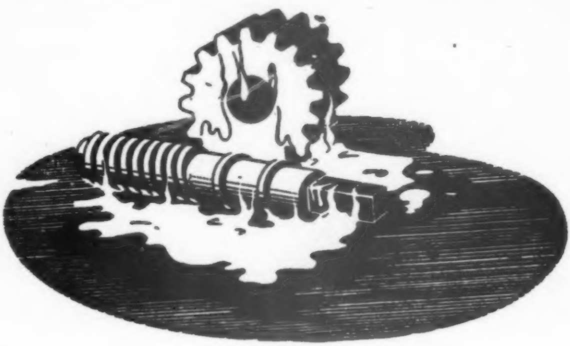

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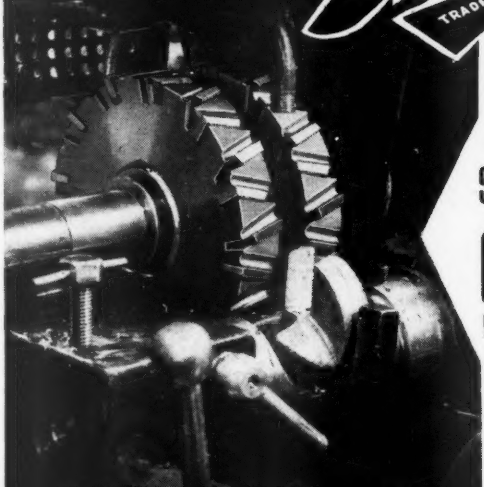

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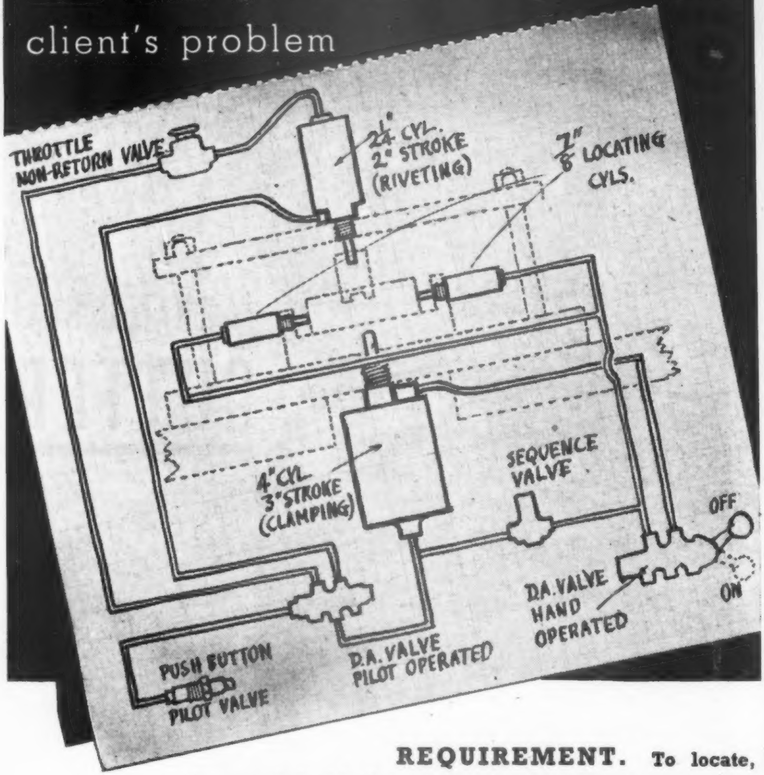

REQUIREMENT. **To locate, clamp and rivet in fixture. Riveting cylinder to be inoperative if component is not clamped and operator's right hand not on valve. Operator's left hand to control riveting operation — thereby engaging both hands as a safety measure.**

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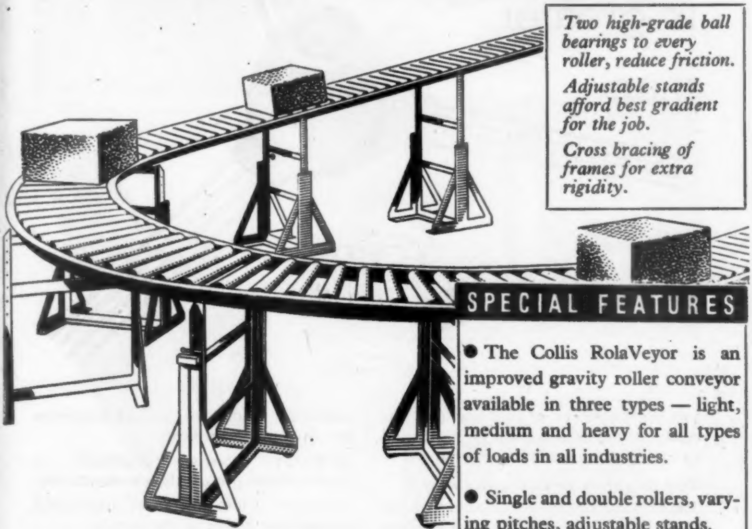

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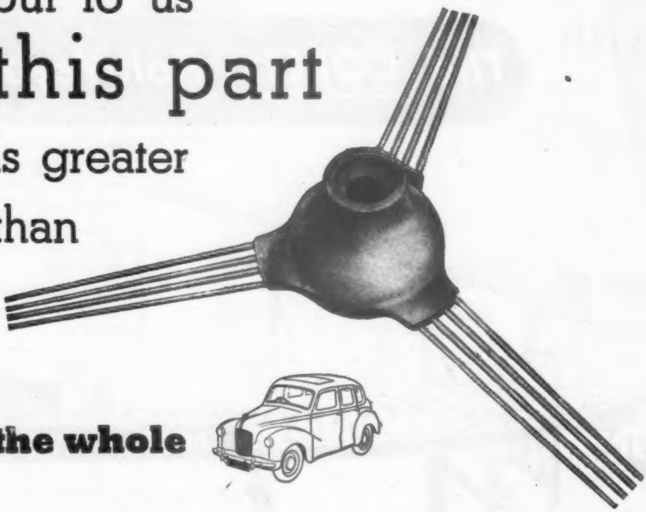

the whole

THE RELIABILITY of this zinc alloy die casting—the steering wheel boss and spring spokes of a car—is vital.

Why the part is die cast in zinc alloy

The boss can be cast in one piece with the steel spokes firmly embedded as inserts, and ready for fixing to the steering column. Cast in its final shape to accommodate horn button and other electrical equipment, it needs no machining before its black or colour finish.

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The modern car contains scores of zinc alloy die castings. Components generally made wholly or partly by zinc alloy die casting, include stressed chassis parts (such as shock absorber bodies), carburettors, and body fittings such as handles and radiator grilles.

Facts about zinc alloy die casting

Speed is the essence of the die casting process — the shortest distance between raw material and finished product. Zinc alloys are the most widely used metals for diecasting because they ensure:

STRENGTH: Good mechanical properties for stressed components.

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Alloys conforming to B.S.1004 should be specified where strength, accuracy and stability are essential.

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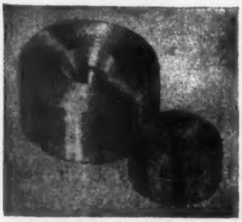
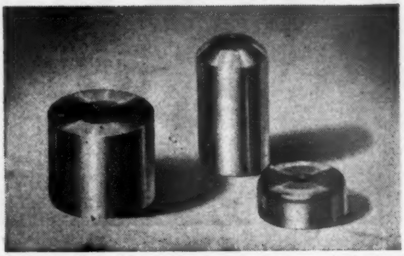


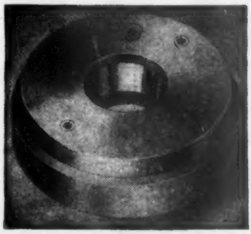
"PROLITE" wire drawing dies

Tipped cutting and jig boring tools

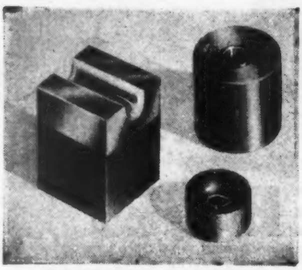


Rivet heading dies, swiss type automatic steady bushes welding rod coating dies and other wear resisting parts.

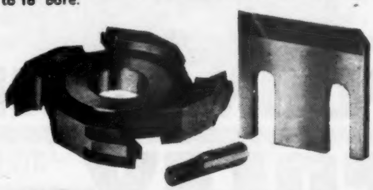
"PROLITE-NURAKE" milling and slotting cutters, for machining metals and non-metals.



Sheet metal forming and sizing dies are made in sizes up to 18" bore.



"PROLITE" wear resisting parts.



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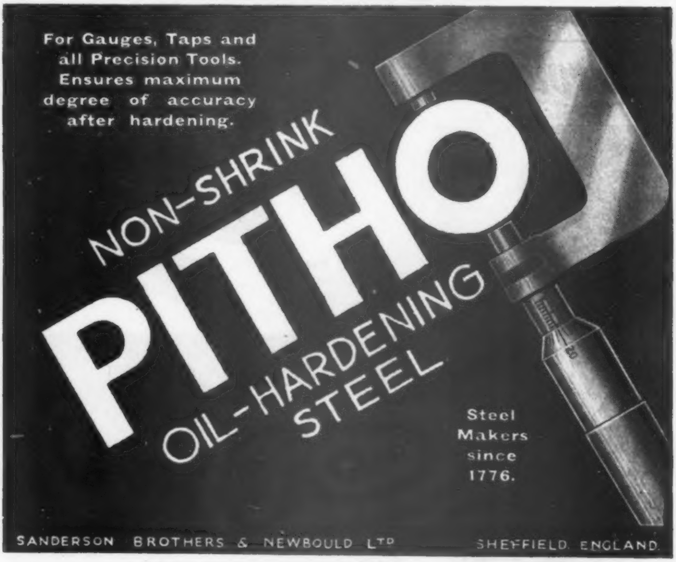

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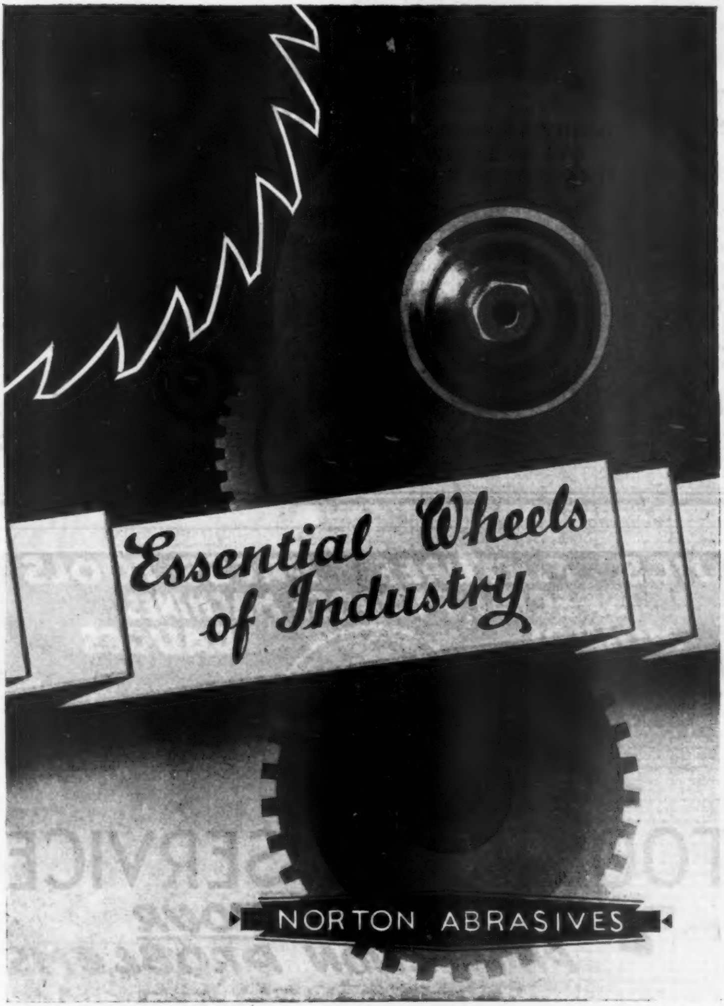

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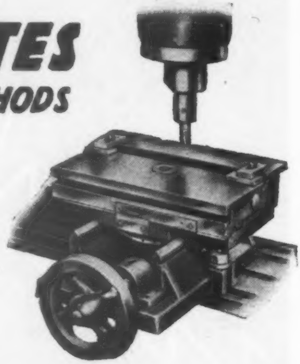

This attachment does not swivel but performs a circular movement generated on two slides which can produce a **full convex or concave** movement without fouling either machine or workpiece. No centralising required. Convex and concave work of various radii can be produced with one width of tool by adjusting the table.

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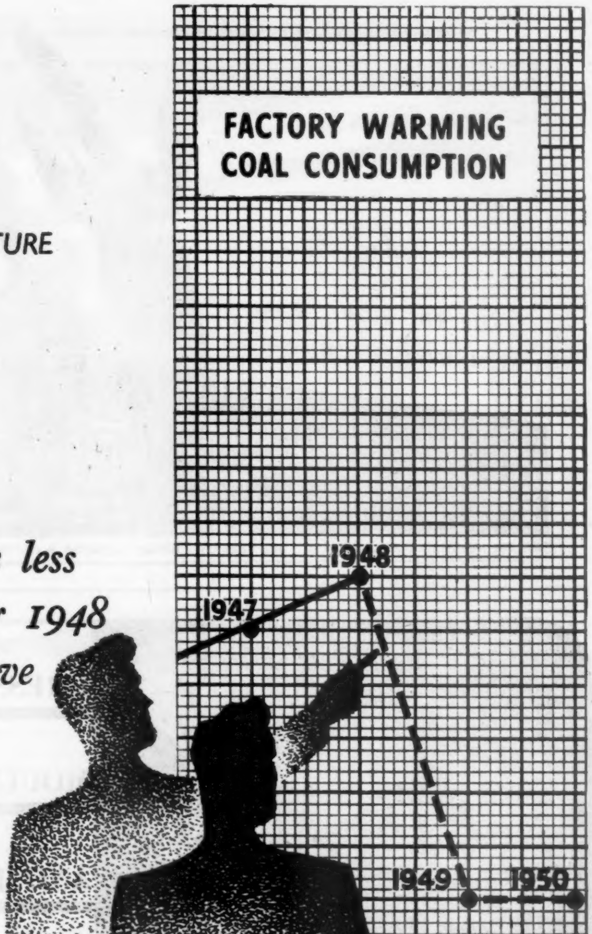

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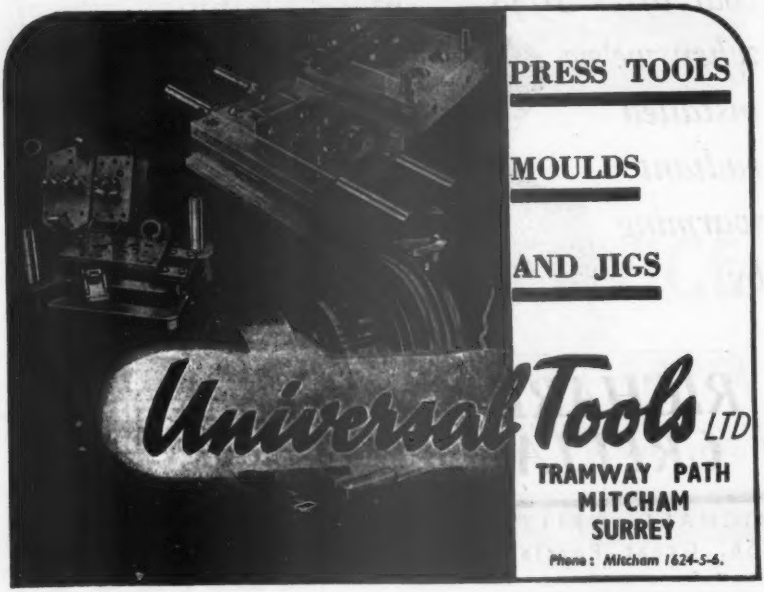
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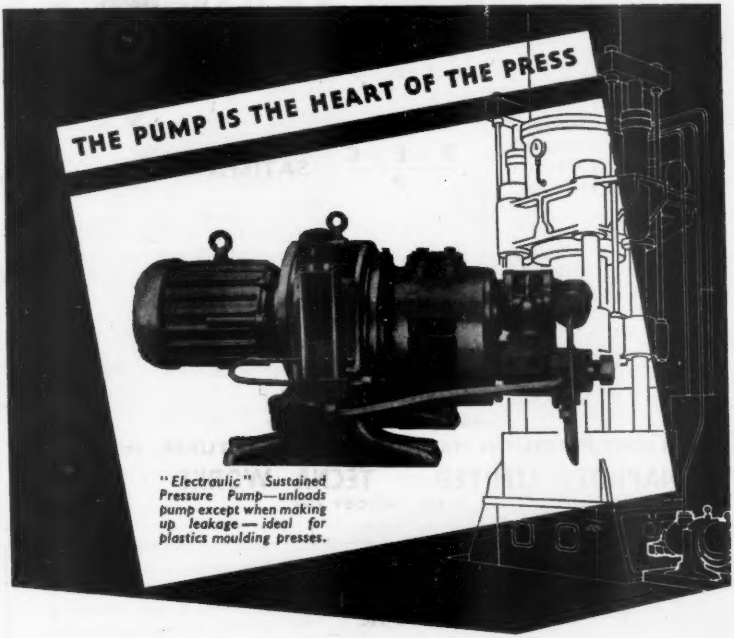

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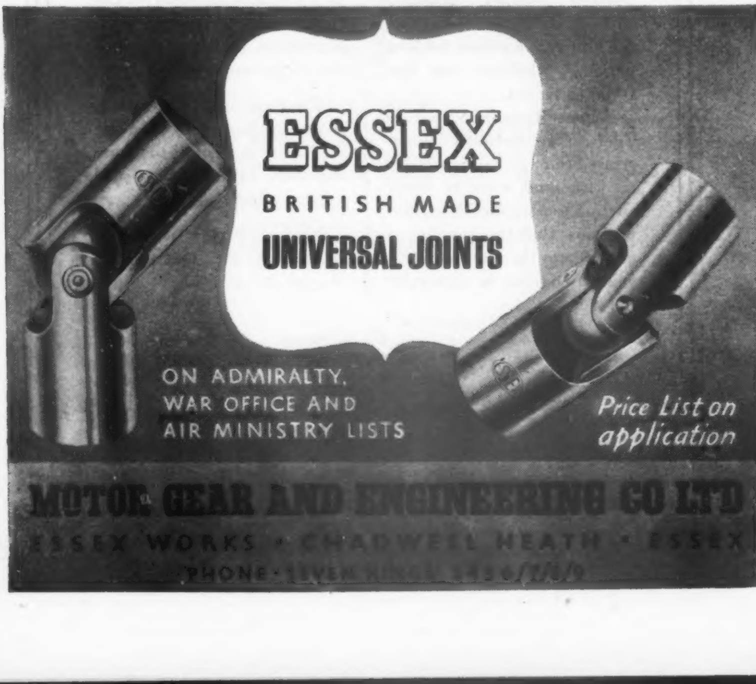
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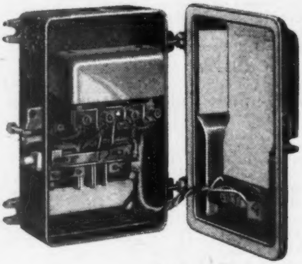

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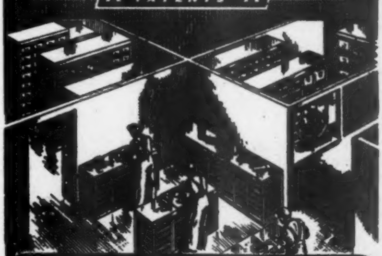

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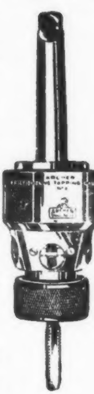

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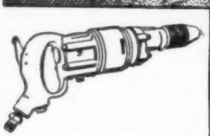

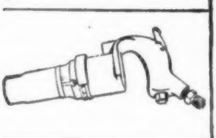

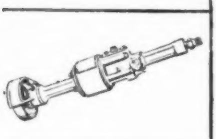

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